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THE SPONGILLA-FLIES, WITH SPECIAL REFERENCE TO THOSE OF THE WESTERN HEMISPHERE (SISYRIDAE, NEUROPTERA)

By Sophy I. Parfin* and Ashley B. Gurney†

Introduction

The spongilla-fly adults are small, dull-colored Neuroptera, similar to the brown lace-wings (Hemerobiidae) in appearance (pl. 3, fig. 4). The larvae are regarded as parasitic on fresh-water sponges. They undoubtedly serve as food for fish and higher aquatic animals and probably have been frequently mistaken for certain crustaceans such as *Cyclops*, which they strongly resemble in manner of swimming. They are of particular interest phylogenetically because they are the only truly aquatic larvae at present known among the Neuroptera, sensu strictu.[1]

The Sisyridae are widely distributed and have been taken in North America (United States, southern Canada, Alaska), Central America (British Honduras, Honduras, Panamá), South America (Brazil, British Guiana, Chile, Perú, Surinam, Venezuela), the West Indies (Cuba), Europe (Great Britain to Russia, Scandinavia to Spain), Africa (Anglo-Egyptian Sudan, Natal, South Africa, and Madagascar), Asia (China, India, Japan), the Philippine Islands, and Australia. Those in the Western Hemisphere have never previously had a comprehensive treatment including genitalic studies. There also has never been a publication in the English language treating the world genera. At the present time, the Sisyridae of the Western Hemisphere

*Entomologist, U. S. National Museum.

†Entomologist, Entomology Research Branch, U. S. Department of Agriculture.

[1] The larvae of the Osmylidae, the closest larval relatives of the spongilla-flies, are only semiaquatic, without tracheal gills, and occur in wet places such as the margins of streams, where they may be found in damp moss feeding on dipterous larvae. The Osmylidae have been taken in South America, Europe, Asia, Africa, Australia, and New Zealand.

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comprise 2 genera and 17 species, of which 8 species are here described as new (tables 1, 2). The distribution of those in the Western Hemisphere is shown on maps (figs. 1, 2).

In the first part of this paper, the literature concerning the history, biology, immature stages, sponge hosts, and enemies of the Sisyridae is brought together, in conjunction with some original observations. The second part deals with the taxonomy of the family, with a key to the genera of the world, and a revision of the species of Sisyridae in the Western Hemisphere. A discussion of the wing venation and terminology used in this paper is included in the section on wing morphology (p. 450).

Previous taxonomic treatments of the family include monographs by Navás (1935) (reviewed by Lestage, 1935), and Krüger (1923) on the world fauna, and a revision of the Nearctic Sisyridae by Carpenter (1940). An extensive treatment of the British species has been given by Killington (1936, 1937).

TABLE 1.—*Genera of Sisyridae in the world*

Genus	*Distribution*	*Page*
Sisyra	Cosmopolitan	456
Climacia	North, Central, and South America	480
Sisyrina	India	517
Sisyrella	Japan	518
Neurorthus	Algeria, Australia, Balearic Islands, Bulgaria, Corsica, Italy, Japan, Sardinia, Sicily, Spain	520
Rophalis	Baltic amber (fossil)	522

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TABLE 2.—*Species of Sisyridae in the Western Hemisphere.*

Genus	*Species*	*Distribution*	*Page*
Sisyra	*apicalis* Banks	United States, Cuba, Panamá	471
	fuscata (Fabricius)	United States, Canada, Alaska	468
	vicaria (Walker)	United States, Canada	460
	nocturna (Navás)	British Honduras	476
	panama, new species	Panamá	474
	minuta Esben-Petersen	Brazil	478
Climacia	*areolaris* (Hagen)	United States, Canada	486
	californica Chandler	United States	491
	chapini, new species	United States	495
	tenebra, new species	Honduras	501
	striata, new species	Panamá	499
	basalis Banks	British Guiana	504
	bimaculata Banks	British Guiana, Surinam	507
	carpenteri, new species	Paraguay	511
	chilena, new species	Chile	515
	nota, new species	Venezuela	503
	townesi, new species	Brazil, Perú	509

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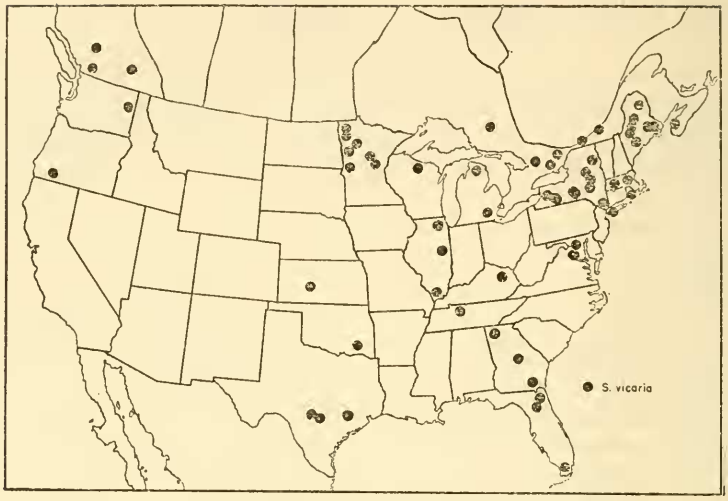
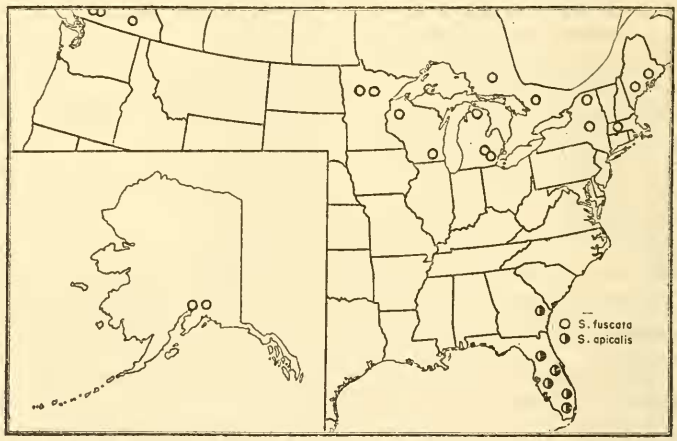
HISTORY

When the family "Hemerobida" was proposed by Leach (1815, p. 138) it was not restricted to the Hemerobiidae as defined today, but even included some Chrysopidae. Banks (1905, p. 23) subdivided the Nearctic Hemerobiidae into three subfamilies, one of which was the Sisyrinae; this included genera now placed in three distinct families, *Polystoechotes* (Polystoechotidae), *Lomamyia* (Berothidae) and *Sisyra* and *Climacia* (Sisyridae). Handlirsch (1906, p. 42) established the family Sisyridae without mentioning any genera; later (1907, p. 908) he included the fossil genus *Sisyra* (*Rophalis*). Banks (1913, p. 211), disregarding Handlirsch's family, included *Sisyra* and *Climacia* in the tribe Sisyrini of the subfamily





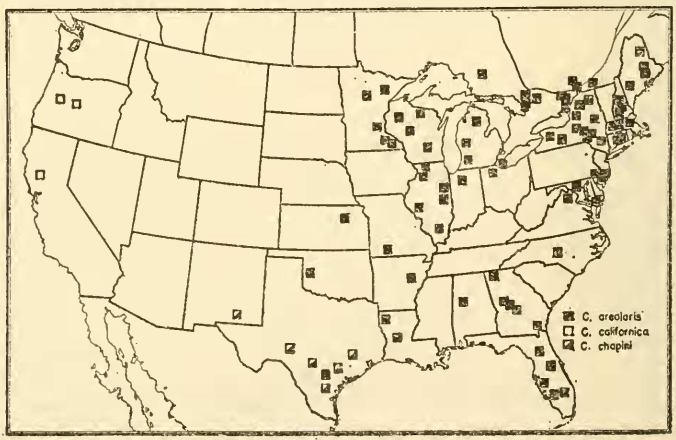


FIGURE 1.—Explanation on facing page.

FIGURE 2.—Neotropical distribution of Sisyridae (specimens examined): *Climacia* and *Sisyra*. (Note: *S. apicalis* also is found in Panamá.)

Osmylinae and placed *Neurorthus* and *Sisyrella* in the subfamily Hemerobiinae of the Hemerobiidae. Nakahara (1914, p. 489) also placed *Sisyra* and *Climacia* in the tribe Sisyrini of the subfamily Osmylinae, and (1915, p. 14) erected the Neurorthini as a tribe of the subfamily Hemerobiinae and included in it the three genera, *Neurorthus* Costa, *Nosybus* Navás, and *Sisyrella* Banks; later Navás (1929, p. 69) transferred *Nosybus* to the Berothidae, and (1935, p. 40) *Sisyrella* to the "Sisyrinos" of the Sisyridae. Krüger (1923, p. 25 et seq.) accepted five genera for the Sisyridae—*Sisyra*, *Sisyrella*,

FIGURE 1.—Distribution of Sisyridae in North America (specimens examined): Top, *Sisyra vicaria* (Walker); middle, *S. fuscata* (Fabricius) and *S. apicalis* Banks; bottom, *Climacia areolaris* (Hagen), *C. californica* Chandler, and *C. chapini*, new species.

Climacia, *Rophalis*, and *Neurorthus*—without designating tribes. Navás (1935, p. 16) divided the Sisyridae into three tribes, "Neurorthinos" (*Neurorthus*), "Sisirinos" (*Sisyra*, *Sisyrella*), and his proposed "Climacinos" (*Climacia*). *Sisyrina* Banks would appear to belong to the "Sisirinos" of Navás; however, the tribes will not be differentiated in this revision.

The Sisyridae are represented in Tertiary deposits of Baltic amber in the Lower Oligocene (*Rophalis*, *Sisyra*?) (see Killington, 1936, p. 5). Handlirsch (1908, p. 1252) concluded from paleontological evidence that the Sisyridae arose from the stem which also gave rise to the present-day families—Coniopterygidae, Hemerobiidae, Berothidae, and Dilaridae. Handlirsch also believed that the other families, including the Osmylidae, arose on six other branches from the main stem. Tillyard's earlier work (1916, p. 272), based principally on the wing venation of fossil and recent groups, suggested that a reduced remnant of the osmyloid stem had thrown off the aquatic Sisyridae and reached the extreme limits of reduction in the Coniopterygidae with their reduced venation. Later (1926, p. 312) he divided the Planipennia into five superfamilies, the Sisyridae being included with the Dilaridae, Psychopsidae, Berothidae, Hemerobiidae, Chrysopidae, Mantispidae, Polystoechotidae, and Osmylidae in the superfamily Hemerobioidea. Carpenter (1940, p. 194) followed this classification in his revision of the Nearctic Hemerobiidae, Berothidae, Sisyridae, Polystoechotidae, and Dilaridae, although he recognized that the families do not form a natural group by themselves. Eventually Tillyard (1932, p. 29) considered the Sisyridae to be a specialized side-branch distinct from both the Dilaridae and Hemerobiidae, with the Ithonidae, Dilaridae, and Hemerobiidae representing one line of evolution, the Prohemerobiidae and the Psychopsidae specialized side-branches, the Berothidae the oldest existing family of Planipennia, and the position of the Coniopterygidae "still as much a mystery as ever, there being no close connections between these highly reduced forms and other Planipennia, either fossil or recent." Withycombe (1925, p. 402), basing his conclusions on the study of the immature stages, divided the Neuroptera into five somewhat different superfamilies and included the Sisyridae and Osmylidae on the same offshoot, with the Dilaridae, Berothidae and Mantispidae, and Myiodactylidae on three later offshoots of the same stem in the Osmyloidea. Although there is a considerable difference in appearance in the adults of the Osmylidae and Sisyridae, Withycombe (ibid., p. 400) believed the Sisyridae to have had osmyloid ancestors, which went into deeper water as larvae and then took to preying upon fresh-water sponges, at the same time developing longer jaws and abdominal tracheal gills and losing the labial palpi; in addition, there was reduction of the two claws into a single claw,

which Withycombe (1925, p. 362) could not explain, although he (1923, p. 505) suggested that the reduction took place by fusion of the two claws laterally rather than by the loss of one.

BIOLOGY

Life History

Although Degeer described a sisyrid, "*Hemerobe velu noir*," in 1771 (p. 713), it was not known until almost 60 years later that the larva was aquatic. Hogg (1841, pp. 390–392; 1843, p. 446) first brought the sisyrid larva (although unrecognized as such) in the fresh-water sponge (*Spongilla fragilis*) to the attention of the Linnean Society of London in a paper read in 1838, while a discussion was raging as to whether sponges belonged to the plant or animal kingdom. Westwood (1839, p. 200; 1839a, p. 380) presented a description of the larva in a London entomological society meeting in December 1838 and published (1840, p. 586) a description; later (1842, pp. 105–108, pl. 8, figs. 1–12) he gave the larva the name of *Branchiotoma spongillae*. Rambur (1842, p. 415) stated that the larva of *Sisyra* was aquatic and (ibid., p. 416) remarked that *Sisyra fuscata* [2] was taken around ponds. Grube (1843, p. 336, footnote) referred the larva to *Sisyra*, mentioning *fuscatus*. Haliday (1848, pp. xxxi–xxxii) compared *Branchiotoma spongillae* with the larva of *Hemerobius* and, noting the frequency of the adults of *Sisyra fuscata* about the places where the sponge-inhabiting larvae were found, suggested that *B. spongillae* was the larva of *fuscata*. Westwood (1848, p. 557) was almost convinced that the "spongilla insect" was the larva of *Sisyra fuscata*. Walker (1853, p. 296) doubtfully placed *B. spongillae* in synonymy with *fuscata;* Brauer (1855, p. 703) questioned the larva of *Sisyra*. Hagen (1851, pp. 185–186) suggested that *B. spongillae* was probably *Sisyra fuscata*, that (1858, p. 25) the larva of *Sisyra* lives in water, and associated (1866, p. 388) *Branchiotoma spongillae* with *Sisyra fuscata*. Withycombe reared two British species of *Sisyra* (see p. 433), and Killington (1932, pp. 31–33; 1936, pp. 226–241) and Kimmins (1944, p. 18) supplemented his observations on the bionomics of the British species.

The first important contribution to the knowledge of the life history of the Nearctic Sisyridae was made by Needham (1901, p. 552), who discussed *Sisyra vicaria* (Walker) (=*umbrata* Needham) and *Climacia areolaris* (Hagen) (=*dictyona* Needham). Later, Old (1933, pp. 681–684) presented a brief general study of the biologies of *Sisyra* and *Climacia*. The most detailed account of the life history of *Climacia areolaris* was given by Brown (1952, pp. 130–160). Balduf (1939) summarized the literature on the bionomics of the Nearctic Sisyridae.

[2] *S. terminalis* Curtis (=*S. fuscata* Rambur not Fabricius) according to McLachlan (1881a, p. cxxxiii).

The eggs are elongate oval, pale yellowish (whitish when freshly laid), have a small disclike micropylar knob which is flatter than and a chorion which is smoother than those of *Hemerobius*. They are approximately 0.35 mm. in length in *Sisyra fuscata*, *S. terminalis* (Withycombe, 1923, p. 520), and *Sisyra* sp. (ibid., 1925, p. 310) and 0.34 by 0.16 mm. in *Climacia areolaris* (Brown, 1952, p. 138). The eggs are usually laid in clusters (averaging 2 to 5 with a maximum of 20 for *areolaris* and 1 to 12 for *Sisyra* (probably *fuscata*)) in depressions on objects overhanging fresh water, such as branches, leaves, woodpiles, docks, etc. They are covered by a whitish silken web of three to four layers, spun as a superposed series of Z's in *areolaris* (Brown, 1952, p. 155) or by a method wherein the female spins a few parallel strands, then shifts her position slightly and spins a few more strands, crossing the first strands, and so on (Withycombe, 1923, p. 520). The ninth sternite of the female contains the opening to the cement gland and is also used for locating crevices in which to deposit eggs.

Hatching usually takes place within eight days to two weeks, the incubation period being partially dependent upon the temperature. At eclosion, blood is forced into the labrum-clypeus and through the pumping and swelling of the underlying tissues, the amniotic egg-burster is pressed against the chorion, rupturing it longitudinally. The egg-burster is long and slender, and possesses a serrate cutting edge, with the teeth towards the base longer and narrower. The larva usually sheds its amniotic skin while working its way out of the shell and pushing through the layer of silk. The larva then drops into the water and forces its way through the surface film of the water, sometimes with difficulty, by bending the tip of the abdomen up over the back to the head, so that the anterior portion of the larva is propelled through the film as the larva straightens out. Then it sinks slowly and drifts along with the head, legs, and tip of abdomen bent under ventrally. A gas bubble or bubbles, possibly serving as a hydrostatic organ, in the gut of the thorax has been thought to control the specific gravity (Withycombe, 1923, pp. 520–521; Brown, 1952, pp. 140–141). The larva swims from time to time by curving the abdomen ventrally, then jerking it out straight and moving the legs simultaneously. Eventually it settles upon a sponge and feeds intermittently by inserting its mandibles and maxillae and sucking the fluids. After feeding, it may clean the antennae and mouthparts with the forelegs, similar to other Neuroptera. Under normal conditions it does not readily leave the sponge before becoming a mature larva.

There are three instars, with the first molt of *Climacia areolaris* taking place at about the end of the first week. When the third-

instar larva is ready to pupate, it crawls to some object upon which it may emerge from the water. It may wander for several hours after leaving the water, occasionally as far as 50 feet or as high as 12 feet, before spinning its cocoon on an appropriate substrate. Brown (1952, p. 149) noted that from about four to eight hours elapsed from the time *areolaris* left the water until it finished its spinning. It spent from 30 to 60 hours in the cocoon as a prepupa before pupating. Needham (1901, p. 556) observed that two larvae of *vicaria* (=*umbrata*) spent at least 12 hours in spinning their cocoons and remained prepupae ("inactive larvae") for 24 hours before pupating. Sisyrid cocoons have been recorded on the bark of trees (crevices), boat hulls, spiderwebs, grass blades and stems, *Scirpus* culms, pine needles, docks, bridges, woodpiles, undersides of stones above water, fibers of hemp rope, corpses or exuviae of other insects (as those of dragonfly naiads and mayfly subimagines), and sometimes adjacent to gyrinid cocoons.

The cocoons of *Sisyra vicaria* and the majority of those of *Climacia areolaris* examined appeared similar and almost single-layered in structure, with the double layer difficult to discern (pl. 3, fig. 6). On the surface of the cocoon may be seen coarse, widely spaced, irregular strands of silk, almost interwoven into the cocoon itself. The strands are frequently pale greenish on the specimens of *vicaria* and yellowish on those of *areolaris* examined; and yellowish on *fuscata* and *terminalis* cocoons, according to Withycombe (1923, p. 523).

Of 19 specimens of *areolaris*, with cocoons from which they emerged (kindly sent by Dr. Hungerford), only three made cocoons which showed the artistic, loose, hemispherical outer net of a widely spaced hexagonal mesh and the whitish inner cocoon of finer, more compact texture attributed to this species (=*dictyona*) by Needham (1901, pp. 559, 560, pl. 12) (pl. 3, fig. 7). The specimens were collected by Hungerford in Cheboygan County, Mich., from July 22 to 26. The 16 specimens without the outer net appear slightly broader, with rounded ends, and more whitish than the *vicaria* cocoons, which are tapered slightly at one end; however, it is realized that type of substrate and age may have some effect on the shape and color of the cocoons. A cocoon of *fuscata* from Holland possessed an outer open net similar to but with smaller and less regularly hexagonal spaces than those of *areolaris*. It is slightly yellowish. The inner cocoon is white, parchmentlike and oval. Killington (1936, pl. 4, fig. 3) showed a photograph of a cocoon of a European specimen of *fuscata* with a similar outer net.

Brown (1952, p. 148) has pointed out that when the *areolaris* larva chooses a cocoon site lacking an adequate substrate (as grass blades and stems, etc.), or sometimes when the substrate is adequate, the

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outer net may be omitted. Whether or not this is true of species of *Sisyra* is yet to be investigated, although it seems possible.

According to Brown (1952, p. 147), the *areolaris* larva accomplishes the spinning of the outer cocoon by first securing a firm foothold; then partially withdrawing its head within the prothorax, it moves its abdomen from side to side, at the same time ejecting from the spinneret the viscid silk. This silk is looped in an arc to the other side, forming a loose, usually hemispherical net. After this, the larva spins the smaller inner cocoon, which is anchored by five or six strands to the outer cocoon or substrate, by first spinning at one end, and then reversing its position and spinning at the opposite end. At pupation the last larval skin is pushed into the posterior end of the cocoon.

A series of 28 cocoons, probably mainly *vicaria*, collected at Nigger Creek, near Douglas Lake, Mich., on *Scirpus* and *Eleocharis* stems (kindly sent by Dr. Spangler) ranged from 3.5 to 5.3 mm. in length (averaging 4.5 mm.), and from 1.7 to 2.4 mm. in width (averaging 2 mm.). The outer net of the cocoon of the specimen of *areolaris* photographed measured 5.5 by 3.9 mm., the inner cocoon 4 by 2.6 mm. The cocoon of the specimen of *fuscata* from Holland (reared by L. F. Byars) measured 5.5 by 3.5 mm., outer net, and 3.5 by 2.5 mm., inner cocoon.

Most adults of *areolaris* emerge at the end of the fifth or sixth day (Brown, 1952, p. 150), while some individuals of *Sisyra* or *Climacia* take as long as 14 days (Needham, 1901, p. 557, 11 days; Withycombe, 1925, p. 523, about two weeks; Old, 1933, p. 682, 8 to 14 days). After first freeing the antennae and other appendages, the pupa bites and forces its way out of the cocoon. The pupa often leaves the cocoon completely before shedding its skin, but sometimes sheds it within after biting an escape hole and only partially emerging. A dark brown fecal pellet enclosed in a peritrophic membrane is deposited within the first one or two hours following emergence. Mating, which is lateral in position, may occur several hours to two weeks after emergence, sometimes in flight, usually in the evening or on a cloudy day. A yellowish white spermatophore, less than 1 mm. in diameter in *Climacia* (Brown, 1952, p. 154), is deposited on the tip of the female abdomen, sometimes after three to five minutes., Withycombe (1923, p. 524) described the spermatophore of *Sisyra* as being "apparently spherical, but slightly lobate." Oviposition takes place in the evening, often only a few hours after pairing, and as many as 45 or more eggs can be laid overnight by a single female.

Brown (1952, p. 153) found pollen grains, which might have been consumed along with nectar, in the fecal pellets of *areolaris* and noted that under laboratory conditions, on a restricted diet of gumdrops and water, the adults of *areolaris* died within two to three weeks, with

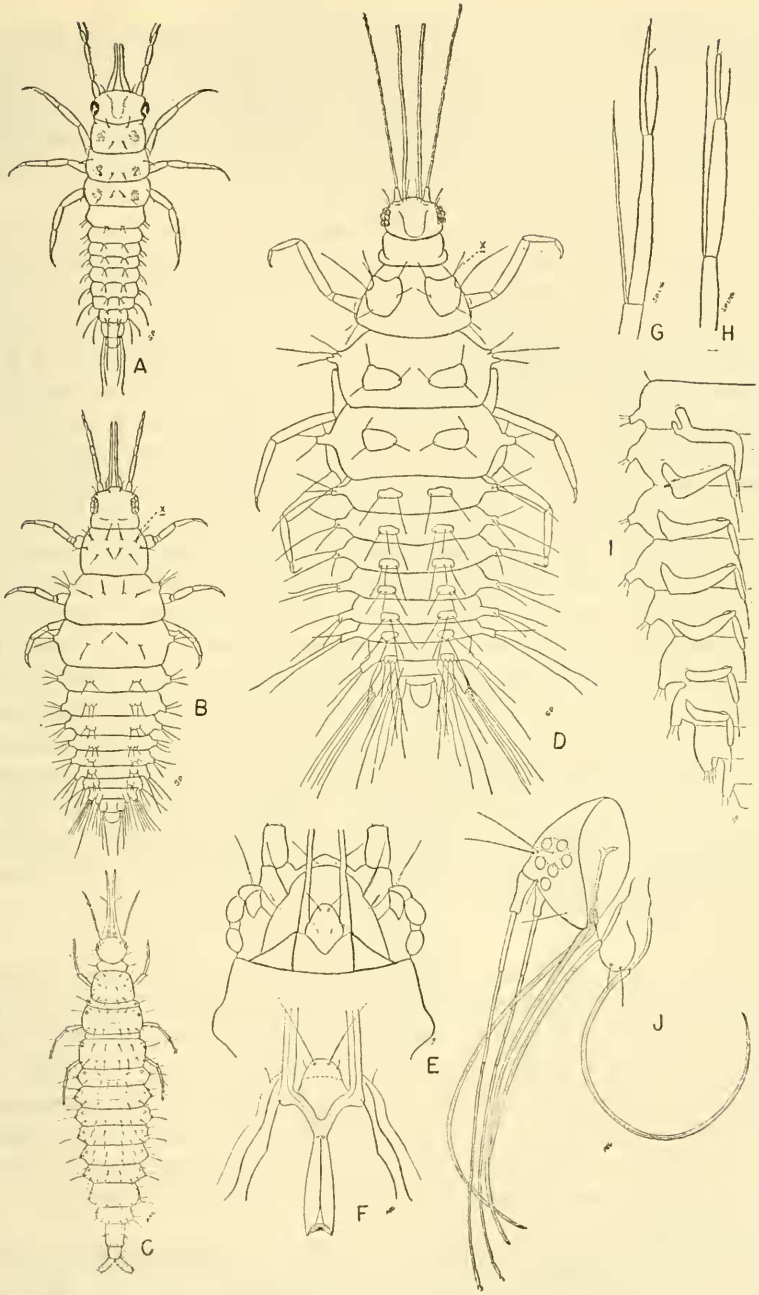

FIGURE 3.—Larvae. A, B, E, F, H, J, *Climacia areolaris* (Hagen): A, 1st-instar larva; B, 2d-instar larva, showing seta *x;* E, 3d-instar larva, head, ventral view; F, same, head dissected, ventral view of bases of mouthparts; H, same, antenna, terminal segments; J, same, head, lateral view of left side and internal view of bases of mouthparts. C, *Osmylus,* 3d-instar larva (adapted from Killington, 1936, pl. 9, fig. 1). D, *Sisyra vicaria* (Walker), 3d-instar larva, showing seta *x;* G, same, antenna, terminal segments; I, same, tracheal gills.

a few living a fourth week. Tjeder (1944, p. 203) observed an adult male of *S. fuscata* first remove and grasp several eggs of *Sialis lutaria* L. (Sialidae) attached to *Carex*, and then feed on them. The adults are typically nocturnal or crepuscular, attracted to light, and may also be taken by beating the shrubs and trees overhanging water in which certain fresh-water sponges abound.

Brown estimated three broods of *areolaris* in the summer in the Put-in-Bay region, Ohio, but did not study the overwintering stage. Needham (1901, p. 560) suggested two broods a year for this species (=*dictyona*) at Saranac Inn, N. Y., based on the presence of adults during the latter part of June and August and their absence in July. On Juanita Island, at Lake George, N. Y., he found adults during the latter part of July and the whole of August (Needham, 1925, p. 116). Withycombe (1923, p. 523) estimated several broods per year in England, the main one in May and June; he also found sisyrid larvae throughout the winter. Killington (1936, pp. 147, 235–236) stated that in England *S. fuscata* overwintered in the prepupal stage within the cocoon and that eggs were laid in May and June and again in August and September. There, most of the larvae from eggs of the earlier oviposition become full-grown by autumn, then leave the water and pass the winter in the prepupal stage within the cocoon, whereas a smaller number of larvae mature quickly in a few weeks and produce a second brood in August and September, with the larvae from this second brood also overwintering in the prepupal stage. The overwintered prepupae pupate in April, May, and June. Berg (1948, p. 144) noticed that the adults of *S. fuscata* were found in Denmark from the close of May to the end of August, being commonest in July and August.

Larvae

The fusiform sisyrid larva differs from the larvae of other families of Neuroptera in the apparent absence of the labial palpi and empodium, and the presence of only one tarsal claw on each leg. The mandibles and maxillae are straight, similar in form, although the mandibles are broader at the base and have small setae at the apices. In all instars the head is rounded. The first-instar larva differs considerably from the second- and third-instar larvae in the absence of tracheal gills, broad head in comparison with the thorax, and the shorter antennae.

The immature stages of only two of the genera, *Sisyra* and *Climacia*, have been treated in the literature. Needham (1901, pp. 552–554, 559, 560, pl. 12) first discussed the larvae, pupae, and cocoons of the Nearctic *Sisyra vicaria* (Walker) (=*umbrata* Needham) and *Climacia areolaris* (Hagen) (=*dictyona* Needham). Anthony (1902, pp. 615–631), a student of Needham, gave a detailed account of the mor-

phology and anatomy of the larva and pupa of the former species. The most complete account of the immature stages of a Nearctic sisyrid is that presented by Brown (1952, pp. 130–160), who described and figured all of the larval stages of *C. areolaris*. Withycombe (1923, pp. 519–524) has published an extensive study of the

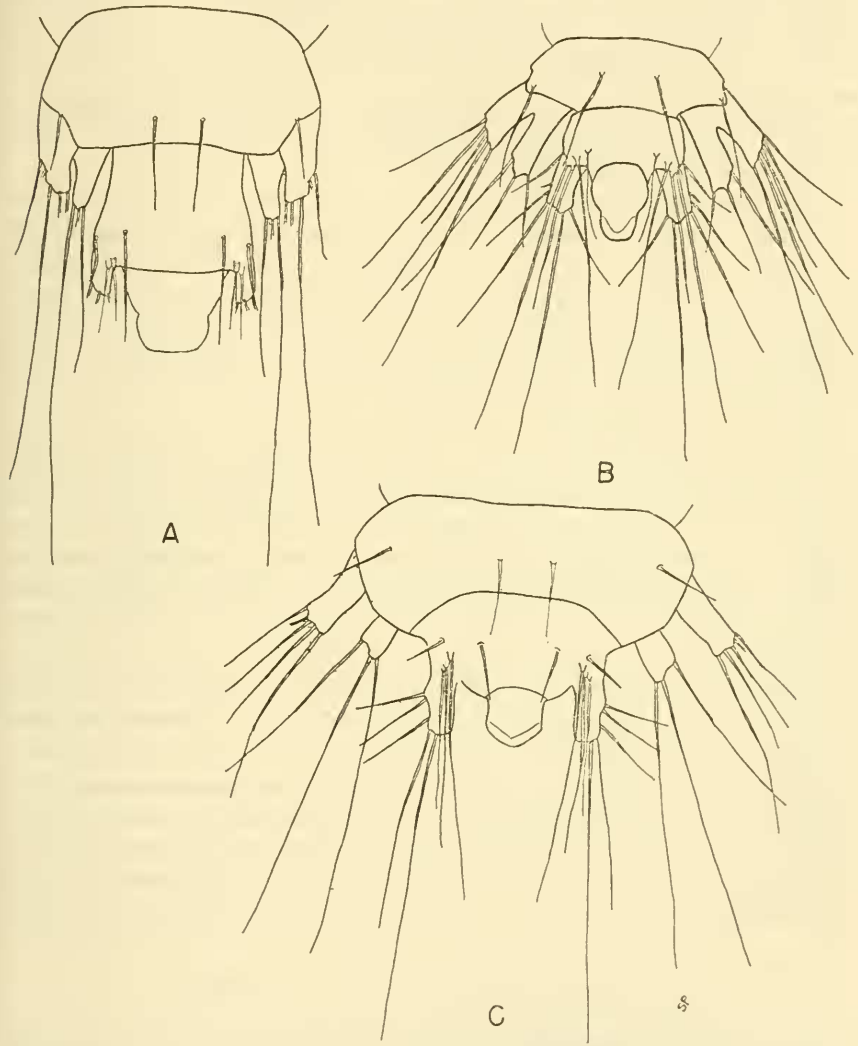

FIGURE 4.—Terminal abdominal segments 8–10 of sisyrid larvae, ventral view: A, *Sisyra vicaria* (Walker); B, *Climacia californica* Chandler; C, *Climacia areolaris* (Hagen).

immature stages of two British species of *Sisyra*—chiefly *fuscata* (Fabricius) but also *terminalis* (Curtis)—which he did not separate, and (1925, pp. 331–333) of *fuscata*. Chandler (1953, p. 184) made a brief statement concerning the third-instar larva of *C. californica*

Chandler. Lestage (1921, pp. 337–339) also described the third-instar larva of *S. fuscata*, and the anatomy of this species is treated by Lampe (1911). Other larval descriptions include those by Needham (1909, p. 206) and Annandale (1906, p. 187) on *Sisyra indica* Needham of India by Esben-Petersen (1933, pp. 628–629) on two larvae, *Sisyra* I and II, from Java. Navás (1925, p. 193, fig. 20; 1935, p. 45) discussed the larva which he named *"Sisyra Arndti"* in connection with *S. dalii* McLachlan.

Specimens of the immature stages of two species of *Sisyra* and two of *Climacia* have been made available for the present study. Data on these specimens are given below.

Sisyra vicaria: two third-instar larvae, pupae (from CU, *umbrata* Needham types and specimens), and cocoons (from P. J. Spangler); *S. fuscata:* two first-instar larvae (reared by C. L. Withycombe, 1922; in MCZ), one cocoon (from L. F. Byars); *Climacia areolaris:* first-, second-, and third-instar larvae, pupae (from H. P. Brown); third-instar larvae, pupae, and cocoons (from H. B. Hungerford); and *C. californica:* third-instar larvae (from H. P. Chandler).

Among the third-instar larvae from Hungerford are specimens of *C. areolaris* and *Sisyra* from Burt and Douglas Lakes, Mich. Adults of *S. vicaria* and *C. areolaris* have been examined from both these localities and of *S. fuscata* from around Douglas Lake. Since the two lakes are approximately 1½ miles apart, it seems probable that the larvae of both species of *Sisyra* are found in the lakes. Examination of the material available failed to reveal any specific differences, however.

Because of certain similarities between the third-instar larvae of *S. vicaria* and *C. californica*,[3] it is difficult to find satisfactory characters for separating this genus from *Climacia* with the material at hand. The lack of second-instar material of *Sisyra* has made comparison of this instar with *Climacia* impossible. Furthermore, the first-instar larvae are so small that some of the characters can be seen only with a research microscope with a magnification of approximately 430×. Accordingly, the keys given below are not as analytical as desirable.

Key to first-instar larvae of Sisyra and Climacia

1. Head with vertex smoothly rounded, brown; pronotum with posterior pair of setae about same distance apart as anterior pair.
Sisyra fuscata (Fabricius)

Head with vertex less rounded, not usually brown; posterior pair of setae closer together than anterior pair (fig. 3,A). . **Climacia areolaris** (Hagen)

[3] From Clear Lake, Calif., the type locality of *C. californica*, determined by H. P. Chandler.

Key to third-instar larvae of Sisyra vicaria, Climacia areolaris, and C. californica

1. Tubercles long, pronounced, with two or three small setalike acute projections at bases of setae (see fig. 5). . . . . **Climacia areolaris** (Hagen)
   Tubercles shorter, with no small setalike acute projections at bases of setae . 2
2. 10th abdominal segment large, usually over ½ as wide as 9th segment; ventral median setae of 8th abdominal segment much closer together than setae of 9th segment; group of two setae on small papillae on each side on 9th segment ventrally (fig. 4,A) . . . . . **Sisyra vicaria** (Walker)
   10th abdominal segment of moderate size, less than ½ as wide as 9th segment; ventral median setae of 8th segment only slightly closer together than those of 9th segment; group of three setae on small papillae on each side of 9th segment (fig. 4,B). . . . . **Climacia californica** Chandler

Note: In fully developed second-instar larvae of *areolaris*, the small setalike acute projections at bases of setae are visible.

First-instar larva (fig. 3,A): The newly hatched larva of *S. fuscata* is about 0.5 mm. long exclusive of mandibles and maxillae, with the jaws about 0.13 mm. long; that of *C. areolaris* is approximately 0.35 to 0.5 mm. long exclusive of jaws, with the jaws from 0.1 to 0.14 mm. in length. The head is almost the same width as the thorax and sometimes slightly broader. The antennae of both species are 5-segmented, with the basal segment broader and shorter than the second or third, the third longer than the second, the fourth narrower, the fifth segment very narrow, acute, and with an apical seta, and the third with a distal spine running parallel with the fourth and usually fifth segments. The jaws are short, stout, straight, slightly longer than the head, and about two-thirds as long as the antennae. The frontal suture, not always apparent, is linear, extending almost to the pronotal margin, where it meets the coronal suture.

The legs are similar and each bears a long, slightly curved, sharp, tapering claw almost as long as the tarsal segment, which approaches the tibia in length. Each thoracic segment bears a pair of dorsal blackish sclerites (sometimes more readily seen after treating the specimen with KOH solution).

In both genera there is a pair of anterodorsal setae on the vertex. Running the length of the thorax and abdomen are four rows of setae, two dorsal and two lateral (one on each side). On the pronotum are an anterodorsal and a posterodorsal pair of setae, the anterior pair more widely separated than the posterior pair, but closer in *areolaris* than in *fuscata*. On the mesothorax and metathorax are two posterodorsal pairs, with the setae more widely spaced than on the abdomen; laterally, there is one seta on each side. On each of the first eight abdominal segments is a pair of posterodorsal and a lateral papilla on each side, each bearing a pair of setae, which become longer towards

the tenth segment; on the eighth segment, the two dorsal papillae are longer than on the other segments and the setae are very long (median ones usually short); on the ninth segment is a posterior row of eight small papillae, each bearing a long seta and with the lateral setae usually closer together; tenth abdominal segment blunt, without setae.

The first-instar larvae of *S. fuscata* and *C. areolaris* could not be satisfactorily compared because the *areolaris* larvae were newly hatched, poorly fed, and consequently thin, with characteristics not yet fully visible, whereas those of *fuscata* were plump, well fed, and exhibited characters much more clearly. The head of *fuscata* was distinctly dark brown and appeared larger and longer in comparison with the thorax than that of *areolaris*, showing the frontal suture clearly and the vertex smoothly rounded.

Brown (1952, p. 143) noted that after the *areolaris* larva is fed for several days, the length of the body may be doubled, with the abdomen becoming especially enlarged.

Second-instar larva (fig. 3,B): Specimens of *areolaris* examined ranged from 1.3 to 1.7 mm. long, exclusive of jaws, with the jaws about 0.5 mm. long. The antennae are composed of six segments, with the long seta arising at the end of the fourth segment and running parallel to the fifth and sixth segments, and with a small seta also arising from the distal end of the fifth; the second segment is the longest, the third short, the fourth longer than the third, and the fifth and sixth small, the sixth particularly narrowed. The mouthparts become longer and more flexible. The head is smaller in comparison with the rest of the body, which takes on a distinctly fusiform shape, widest at the metathorax and tapering anteriorly and posteriorly. The pronotal collar is beginning to become differentiated. The legs show a black ring around the distal ends of the femora and coxae and a shortening of the tarsus proportionally.

There is an additional pair of setae on the vertex just mesad of the eyes. On the dorsum of the pronotum are two pairs of five setae on small papillae, with papilla *x* (fig. 3,B) usually bearing two setae. Each of the two dorsal rows of small papillae on the mesonotum and metanotum and the first abdominal segment bears two pairs of setae, more widely spaced on the mesonotum and metanotum. On the second to seventh abdominal segments the two dorsal rows of papillae bear three setae each; on the eighth segment the two dorsal tubercles become longer and narrower, but still bear three setae each; on the ninth segment there are only two enlarged stout lateral tubercles, which bear three setae each. Each tubercle of the lateral row of tubercles on the mesothorax and metathorax, and on the first seven abdominal segments, bears three setae (which become progressively

longer towards the eighth segment), whereas those of the eighth segment become stout and bear five setae.

Ventrally on each of the first seven abdominal segments is a pair of jointed external tracheal gills containing two trunks that pass forward and medially, appearing to unite in the longitudinal center of the prothorax (according to Brown, 1952, p. 145).

THIRD-INSTAR LARVA (fig. 3,D): The specimen of *S. vicaria* from the Cornell collection measured 3.2 mm. exclusive of jaws, the jaws being 1.4 mm. long; the *Sisyra* specimens from Douglas Lake, Mich., ranged from 3.6 to 6.0 mm. exclusive of jaws, the jaws from 1.4 to 1.9 mm.; the larvae of *C. areolaris* ranged from 1.8 to 5.1 mm., the jaws being 0.9 to 1.1 mm.; those of *C. californica* ranged from 2.8 to 4.5 mm., with the jaws being 0.9 to 1.5 mm. in length. Withycombe (1923, p. 522) gave 5 mm. (exclusive of jaws) for a full-fed *S. fuscata* or *terminalis* larva. Berg (1948, p. 145) stated that the larvae of *S. fuscata* (probably third-instar) reached their largest size, 6.5 mm. (exclusive of jaws), in the autumn (Susaa River, Denmark). Both *vicaria* and *areolaris* larvae which recently molted were hardly longer than a full-grown second-instar larva. The tubercles and setae on the just-molted third-instar larvae appeared considerably longer than those on more fully fed or migrating larvae. The jaws are greatly lengthened, more slender in comparison with the rest of the body, more flexible, and can be readily bent at their apices.

The antennae are also greatly elongated and at times there is variation in the number of segments (one or two) and in the lengths of corresponding segments in the two antennae. The antennae of *vicaria* consist of 15 segments in one specimen examined; they are broken on all the other specimens. Anthony (1902, p. 620) found 16 segments in most specimens that she examined. The antennae of *areolaris* consist of about 16 segments, and there are about 14 in *californica*. The segments beyond the basal, with the exception of the apical ones, are of almost equal diameter, and show variations in length, although being almost equal. In one specimen of *areolaris* examined, there were 14 segments in the left antenna and 16 in the right, with the lengths as in table 3.

In both *Sisyra* and *Climacia* the three terminal segments bear one or two small spines, the antepenultimate segment bearing at its distal end the longest, which runs parallel with the last two segments (fig. 3, G, H). The penultimate segment also bears distally a shorter spine running parallel with but barely reaching the distal end of the last segment. At the distal end of the terminal segment are two spines, both shorter than the penultimate spine, the much shorter, minute one from the opposite side in *areolaris* and terminal in *vicaria*. The terminal segment appears to be longer, thicker, more curved,

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and ending acutely in *Sisyra* and more bluntly in *Climacia*. Lestage (1921, fig. 101) has figured the terminal antennal segments of *S. fuscata*.

The pronotal collar (subsegment, pseudosegment) is distinct. The tubercles are longer, more elaborate on some of the segments. There are more body setae. Additional pairs on the head include one seta between the ocelli of each eye, a median pair on frons near vertex, and a pair on clypeus ventrally. Sometimes a sixth pair is visible on the vertex near the pronotum (*californica*).

Ventrally on the head, the more posterior setae adjacent to the eye appear small in *areolaris*, and larger in *californica* and *vicaria* (fig. 3,E). A third seta-bearing tubercle has been added on the plates of the two dorsal rows of setae of the mesonotum and metanotum in the four species (*vicaria*, *fuscata*, *areolaris*, *californica*). On the dorsal plates of the abdomen there is an additional pair of setae, one

TABLE 3.—*Comparison of lengths of segments in right and left antennae of a third-instar larva of* Climacia areolaris

Right antenna	*Left antenna*
Segment 2 longest	Segment 2 equal to segments 2 plus 3 of right antenna
Segments 3–5, 9, 11–13 about equal, and one-third length of segment 2	Segments 3, 6, 10, 11 shorter than segments 4, 5, 7–9
Segments 6–8, 10, shorter than segments in above group	
Segment 14 second longest, about half length of segment 2	Segment 12 second longest
Segment 15 tapered, acute apically, about half length of segment 14	Segment 13 tapered, acute apically, about half length of segment 12
Segment 16 very narrow, acute apically, about half length of segment 15	Segment 14 very narrow, acute apically, about half length of segment 13

on either side of the median line. Thus, in the third-instar larva, the two dorsal rows of setae are borne on plates on the prothoracic and first seven abdominal segments, with five to six (the sixth seta, *x*, fig. 5,A–C) setae on the prothoracic plates and three each on the mesothoracic, metathoracic, and abdominal plates. On the eighth segment the dorsal setae are on enlarged tubercles, each bearing three long setae. On each side of the middordsal line of the eighth abdominal segment of *areolaris* is a seta on a distinct, minute tubercle. These were difficult to see in the *vicaria* and *californica* larvae; those of *vicaria* are not on tubercles, but sessile and short. The two lateral rows of tubercles bear three long setae each on the mesothoracic, metathoracic, and first seven abdominal segments. On the eighth segment, there is a pair or tubercles on each side, the larger of the two

bearing five long setae, and the smaller, three. On the ninth, the lateral tubercles are more complex, with three to five long setae. Ventrally, on the eighth and ninth segments, is a transverse row of four setae, the median pair closer together on the eighth segment than on the ninth (particularly close in *vicaria*); also on the ninth, small, narrow tubercles on each side ventrally bear long setae, usually two in *vicaria* and three in *californica* and *areolaris* (fig. 4). On the tenth segment, small hairs are visible and a pair of eversible abdominal appendages (rarely used, according to Withycombe, 1925, p. 332) are also present; the tenth segment is longest in *vicaria*.

The dorsal setal sclerites or plates are now clearly defined and assume shapes of specific importance. Those of *vicaria*, *areolaris*, and *californica* are compared in figure 5. It is seen that those of *vicaria* and *californica* closely approach each other in general, with those of the first three abdominal segments appearing more pedunculate in *vicaria*. Around the bases of the setae are found minute setalike projections in *areolaris*.

The folded, ventral, tracheal gills on the first seven abdominal segments of *vicaria* (fig. 3,1) were examined and described by Anthony (1902, pp. 618–619, fig. 5). Although Westwood (1842, pl. 8, fig. 210) figured the gills with five joints, Anthony found only three segments on the second to seventh pairs, but two on the first pair, which seemed to lose the articulation between the first and second segments. As pointed out by Anthony, the first pair has a basal hooklike projection, which gradually decreases in prominence, disappearing almost entirely on the gills of the posterior segments. On each pair of gills except the first, the first segment is shallowly notched at its articulation point with the second, with the basal end considerably longer and more curved than the distal. The point of attachment of the straight, shorter, second segment is at the notch. The gills are transparent, slender, acute distally and directed posteriorly while at rest. In life, they often extend beyond the abdomen almost as far as the long setae. Brown (1952, p. 145) noted that the gills are intermittently vibrated most of the time, so that the ventral surface of the body appears blurred.

The gills of *Climacia* appear to be similar in structure to those of *Sisyra*. On the specimens examined, they appeared sometimes with the first segments broad and the terminal ones either partially absorbed or missing. The spiracles can be seen anterior to each of the lateral tubercles on the first eight segments.

The color of the larva appears to vary from brownish to greenish, depending to a certain extent upon the sponge fed on. A faint indication of brownish black pigmentation along the middorsal line was visible on some of the specimens in the form of paired anterior spots.

Spots are broadest on the mesonotum and metanotum, and smaller and diverging on the abdominal segments. Brown (loc. cit.) observed that the details of the pattern differed among various individuals and

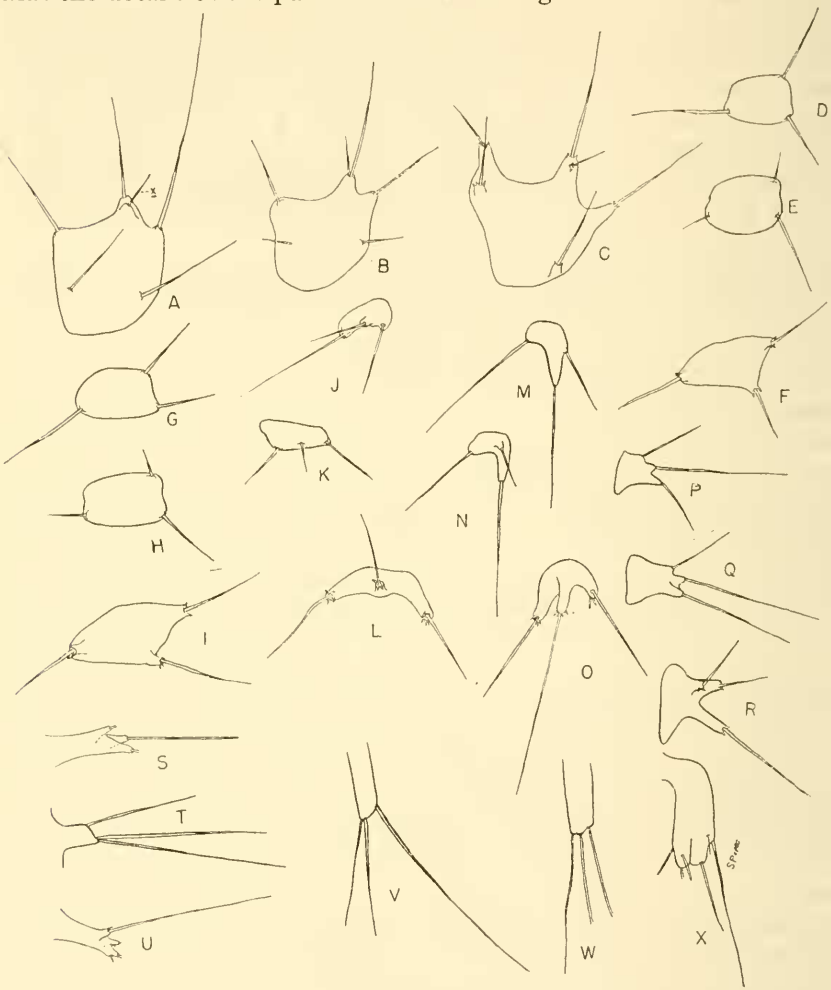

FIGURE 5.—Right dorsal plates and lateral tubercles of sisyrid larvae: *Sisyra vicaria* (Walker), A, D, G, J, M, P, S, V; *Climacia californica* Chandler, B, E, H, K, N, Q, T, W; *C. areolaris* (Hagen), C, F, I, L, O, R, U, X. A–C, dorsal pronotal plates showing seta *x;* D–F, dorsal mesonotal plates; G–I, dorsal metanotal plates; J–L, dorsal plates of second abdominal segments; M–O, dorsal plates of sixth abdominal segments; P–R, lateral mesonotal tubercles; S–U, lateral tubercles of sixth abdominal segments; V–X, dorsal tubercles of eighth abdominal segments.

that the gut contents often give the midthoracic area a reddish or orange appearance.

In addition to the presence of 5-segmented labial palpi, an empodium, and two tarsal claws, the larvae of the Osmylidae can be

separated from the sisyrid larvae, with which they appear to be closely allied, by the following characteristics: No tracheal gills in any instar; antennae 3-segmented, shorter than jaws in all instars; jaws curved slightly upwards and outwards; two transverse rows of setae on mesothorax, metathorax, and first eight abdominal segments; and tenth segment with pair of eversible processes covered with recurved hooks (fig. 3,c).

As in all Neuroptera (sensu strictu), the food of the larva is almost entirely fluid, and is sucked up through two tubes or canals formed by the closely appressed maxillae and mandibles, which are grooved on their inner surfaces. Each mandibulomaxillary canal so formed is open distally near the apex and proximally near the base (fig. 3,F,J). A transverse cleft ("mouth" in *Myrmeleon formicarius*, Lozinski, 1908, p. 477) between the bases of the jaws is kept shut by the close apposition of the labrum into a depression of the labium as pointed out in *Myrmeleon* by Lozinski and in *Dytiscus* (Coleoptera) by Snodgrass (1935, p. 287). The preoral food cavity (cibarium) just within the cleft is open not only at each end at the basal apertures of the canals but also internally at the true mouth (Snodgrass) leading into the stomodaeum. The anterior part of the stomodaeum is the pharynx, and it is the sucking pump with dilator and compressor muscles attached to it in *Myrmeleon* (the "pharyngeal pump" of the Neuroptera as of Withycombe, 1925, p. 368). Withycombe (1923, p. 503) speaks of the mouth being closed by a membrane or integument of the head immediately after hatching. The membrane is later retracted into the head. This bears investigation, since it may possibly be a condition present in other insects.

The midgut is a large sac closed at the posterior end and occupying the anterior two-thirds of the abdomen. The small amount of solid waste appears to be stored up in the posterior end of the midgut and deposited as a fecal pellet in a peritrophic membrane after the emergence of the adult.

The hind gut in *Sisyra vicaria* seems to be closed to any appreciable passage of solid excrement and to consist of almost a solid cord of atrophied cells that ends in the walls of a dilated silk receptacle, leading to the rectum, anus and spinneret, according to Anthony (1902, pp. 623–625). The thin walls of the silk receptacle have a cellular structure, similar to that of the Malpighian tubules from which the silk is spun through the anus. When the larva is about ready to secrete silk, the tubules are modified in their middle portions by the presence of larger, more irregularly shaped cells with ramified nuclei. The five tubules of *vicaria* (Anthony, 1902, p. 623) are attached at their anterior ends to the junction of the hind gut and midgut—with three of them also attached at the posterior end (apparently to the

hind gut just anterior to the silk receptacle) but the other two are attached at the anterior end only with their distal ends extending free in the body cavity. Fluid waste may possibly be drained off by the Malpighian tubules attached at both ends (which function throughout the larval life), the fluid probably being passed through the silk

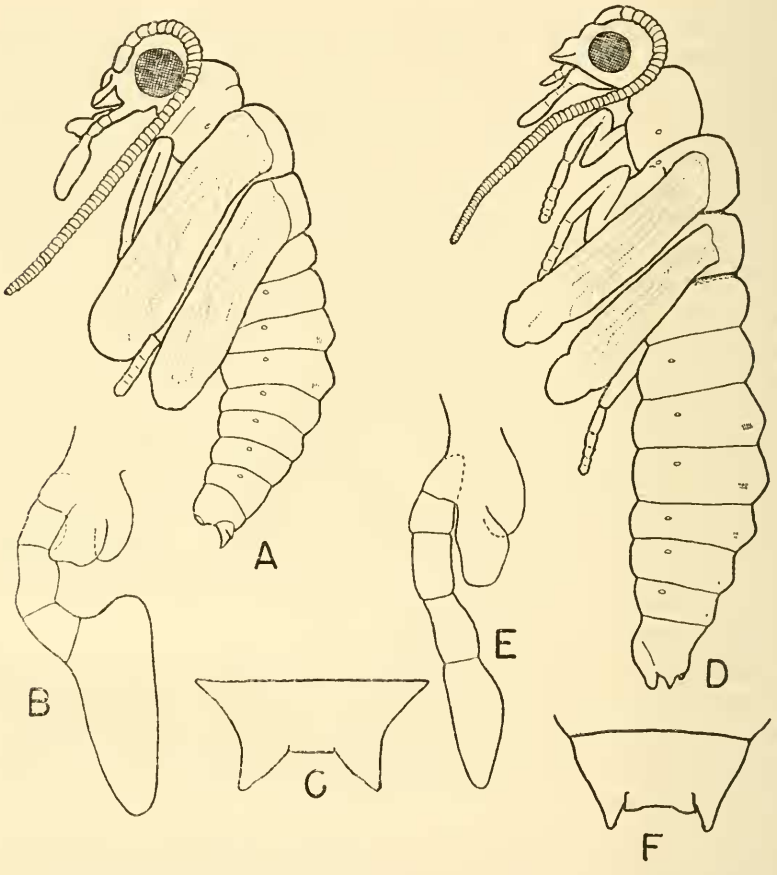

FIGURE 6.—Pupae of *Sisyra* and *Climacia*. A, *Sisyra vicaria* (Walker); B, same, maxillary palpus; C, same, tenth tergite, dorsal view; D, *Climacia areolaris* (Hagen); E, same, maxillary palpus; F, same, tenth tergite, dorsal view.

receptacle and the rectum. The spinneret occupies the last three abdominal segments in *vicaria*. Withycombe (1923, p. 524) recorded eight tubules usually (sometimes seven) in *fuscata* and *terminalis*, with six being looped as usual and the posterior two-thirds pigmented a dark brown (Withycombe, 1925, p. 368).

Pupae and Cocoons

The exarate pupa is typically neuropterous, slightly C-shaped, with the head and terminal segments of the abdomen bent ventrally (fig. 6). The antennae usually lie curved over the wings and the legs are drawn up. The eyes darken first within a day or two after pupation. The pupal mandibles are armed with a broad, blunt tooth on the inner surface and are more or less symmetrical.

Killington (1936, p. 133) noted that in *S. fuscata* each of the third to seventh abdominal segments bears a pair of (latero-) dorsal ridges with small sclerotized hooks; on the third to fifth segments the hooks are in double rows. The hooks of the anterior rows are anteriorly directed, while those of the posterior rows are posteriorly directed. There are approximately 24 hooks on the third and fourth segments; on the fifth the two ridges each carry about ten hooks; on the sixth and seventh segments each ridge usually bears three posteriorly directed hooks, with six (occasionally four) on each segment. On the pupae of *S. vicaria* and *C. areolaris* examined, hooks are also present, although it was not possible to accurately determine the number. There are setae on each side of the hooks.

A color pattern appears on some of the pupae and the sexes can be readily distinguished upon examination of the end of the abdomen.

In addition to the characters pointed out in the key, the wings of the fully developed pupa of *Climacia* appear longer in proportion to the width than in the *Sisyra* specimens examined.

The cocoons are described on page 429.

Key to pupae and cocoons of Sisyra and Climacia

1. Maxillary palpi with 5th or terminal segment broadly triangular, more than twice the width of the 4th; tips of foretarsi barely extending beyond maxillary palpi; cocoon usually close-woven, frequently appearing almost single-layered (*vicaria*) (fig. 6, A–C; pl. 3, fig. 6), but sometimes with an outer layer of irregularly and closely spaced open hexagonal mesh, separate from inner layer (*fuscata*) . . . . . **Sisyra**
2. Maxillary palpi with 5th or terminal segment more cylindrical in shape, narrow, less than twice the width of 4th; tips of foretarsi usually extending beyond maxillary palpi; cocoon sometimes appearing single-layered, but other times with an outer tentlike layer of a strikingly artistic regularly and widely spaced hexagonal mesh (*areolaris*) (fig. 6,D–F; pl. 3, fig. 7) . . **Climacia**

Sponge Hosts of Sisyrid Larvae [4]

Fresh-water sponges, which have thus far been reported to serve as hosts for sisyrid larvae, all belong to the family Spongillidae (class Desmospongeae, order Haplosclerinae). These are included in two

[4] The approved names of the sponges have been obtained from Dr. F. A. Chace, Jr. (USNM), and Mrs. N. G. Benson (Nashville, Tenn.).

TABLE 4.—*Records of fresh-water sponge hosts of sisyrid larvae*

Locality	Sponge	Sisyrid larva	References
United States	*Spongilla fragilis* Leidy	*Sisyra vicaria* (Walker)	Needham, 1901, p. 5[illegible] Brown, 1951, p. 103; 1952, p. 157
		Climacia areolaris (Hagen)	Needham, 1901, p. 560 Brown, 1949, p. 30; 1951, p. 103; 1952, p. 157
Great Britain	*Meyenia fluviatilis* auctorum, sense of Carter (=*Ephydatia fluviatilis*)	*Sisyra fuscata* (Fabricius) *Sisyra terminalis* Curtis Sisyridae	Withycombe, 1923, p. 521 Ibid. Killington, 1936, p. 235; Kimmins, 1944, p. 12
	Spongilla lacustris Linné	*Sisyra fuscata* (Fabricius) *Sisyra terminalis* Curtis Sisyridae	Withycombe, 1923, p. 523 Ibid. Killington, 1936, p. 235; Kimmins, 1944, pp. 11–12
Denmark	*Meyenia fluviatilis* auctorum, sense of Carter (=*Ephydatia fluviatilis*)	*Sisyra fuscata* (Fabricius)	Berg, 1948, p. 144
	Spongilla lacustris Linné	*Sisyra fuscata* (Fabricius)	Ibid.
India	*Spongilla alba* Carter *Spongilla carteri* Bowerbank	*Sisyra indica* Needham *Sisyra indica* Needham *Sisyra* sp. (later described as *indica* by Needham)	Needham, 1909, p. 206 Ibid. Annandale, 1906, pp. 194–195
Java	*Meyenia crateriformis* Potts (=*Ephydatia crateriformis*)	*Sisyra* sp. (larva)	Esben-Petersen, 1933, p. 626
	Spongilla carteri Bowerbank	Sisyridae (larva)	Ibid.

genera, *Meyenia* of the subfamily Meyeninae, and *Spongilla* of the subfamily Spongillinae (table 4).

Brown (1952, p. 157) noted that sponges from comparatively cool, clean Lake Erie yielded only *Climacia* larvae, whereas those from the warm, shallow, polluted Haunck's Pond (on Middle Bass Island) in Ohio yielded only *Sisyra* larvae. Sponges occurred at depths ranging from just beneath the surface to over 6 feet. Those in well-lighted places were green; those farther down were yellowish brown. Hungerford collected both *Sisyra* and *Climacia* larvae from Burt and Douglas Lakes in Michigan.

Old (1933, pp. 683–684), in his observations on the Sisyridae in Douglas Lake, Mich., mentions the sponges (*Ephydatia fluviatilis*, *Heteromeyenia repens*, and *H. argyrosperma*) on which he was unable to find any sisyrid larvae, but does not mention the species on which he *did* find them.

Wesenberg-Lund (1939, p. 23) remarked that the number of *Sisyra* larvae living on large colonies of sponges is not great, hardly more than 10 to 15 individuals. Berg (1948, p. 22) noted that the number

TABLE 5.—*Records of predators attacking Sisyridae*

Prey	Stage attacked	Predator	Reference
Sisyra vicaria (Walker) (=*umbrata* Needham)	adult	tree frogs (in stomach)	Needham, 1905, p. 15
Sisyra fuscata (Fabricius)	adult	*Scatophaga stercoraria* Linné (Diptera)	Killington, 1932, p. 32
	adult (thorax and abdomen)	Trombidiid or "Allothrombiid" mite larvae, determined from Berg's figures 59b,d, as *Microtrombidium* sp., family Trombidiidae, by E. W. Baker (USNM)	Berg, 1948, pp. 145-146, figs. 58-59
Climacia areolaris (Hagen)	eggs and 1st-instar larvae	mites (Acarina)	Brown, 1952, p. 156
	1st-instar larvae	larger plankton feeders, as *Hydra* and *Utricularia*	Ibid.
	3d-instar larvae	fish	Ibid.
		centipedes (3 specimens of *Scutigera* were observed to feed on larvae at one time)	Ibid.
		spiders (orb weaver observed to hold 2 larvae with feet while feeding on a third)	Ibid.
		ants	Ibid.
	adult	Attidae (small gray jumping spiders; eat everything but wings)	Ibid.

of *S. fuscata* larvae on a sponge colony is small in stagnant waters; however, in the Susaa River, Denmark, on a portion of a colony "only half as large as a hand," he found 25 larvae, and concluded that there were undoubtedly several hundred on the whole colony.

Navás (1935, pp. 76–78) has given a fragmentary list of a few sponges found in certain countries, but he has not correlated most of them with species of Sisyridae. Lestage (1921, p. 340) has stated that the larvae occur as parasites upon filamentous algae and bryozoans such as *Cristatella mucedo* in addition to the sponges. Wesenberg-Lund (1939, p. 385) mentioned that *Sisyra* larvae are often found on *Cristatella*. However, Brown (1952, p. 158) pointed out that third-instar *Climacia* larvae have been found upon algae-covered rocks and beneath bare rocks, but that they were not feeding. The fully grown third-instar larva leaves its host sponge and may wander about or hide in protected places during its last day in the water, and usually does not leave the water to look for a pupation site until evening. Consequently, he concluded that it is possible that such migrating or resting larvae, found upon algae or bryozoans, might have been the basis of Lestage's statement.

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Enemies

In addition to unfavorable ecological conditions (including the physical factors of wind, water, temperature, sunlight, etc.), the Sisyridae, in fulfilling their role in the balance of nature, are subject in all stages of their development to the attacks of predators and parasites (tables 5, 6).

Family SISYRIDAE

Small, dull-colored spongilla-flies;[5] larvae aquatic.

Diagnosis (adult): Compound eyes large, widely separated, ocelli absent; antennae setose, approximately one-half the length of forewing, basal segment enlarged, flagellum moniliform and multisegmented; mandibles well developed, maxillary palpi 5-segmented and labial palpi 3-segmented with terminal segments expanded; prothorax broader than long, lateral margin without lobes; legs cursorial, forecoxae elongate and free; abdomen cylindrical. Wings subequal, oval, apices usually rounded. Forewing: costal area narrow in general, particularly narrowed at base to about humeral cross-vein, then widened, and narrowed again just before pterostigma, costal cross-veins usually simple, rarely forked, pterostigmal cross-veins numerous, poorly defined; humeral cross-vein not recurrent; Sc with apical end weak, sometimes appearing fused with R1, at other times appearing free to margin or atrophied before margin, and connected by a radial cross-vein; Rs separating from R1 near base of wing; Rs coalesced with MA for a short distance, then separating, free stem of Rs with from one to two main branches; R1, Cu1 and branches of Rs and M usually with marginal forks, sometimes anal veins also, somewhat variable in extent; Cu1 with almost parallel branches to margin; Cu2 (usually simple, sometimes forked at margin) and usually three anal veins present; cross-veins few and specialized, gradates sometimes present. Hindwing: costal area narrow, cross-veins unforked, pterostigmal cross-veins numerous, poorly defined; MA coalesced with MP at base, then separating into a free, weakened, sometimes somewhat sinuate, elongate basal section, eventually coalescing with Rs for a longer distance than in forewing; Cu2 present and simple; fewer cross-veins than in forewing; gradates sometimes present. Membrane covered with microtrichia, longitudinal veins and costal cross-veins with both micro- and macrotrichia; trichosors present on distal portions of outer and inner margins; a fringe of setae along margins; some thyridia also present; coupling apparatus consisting of a reduced jugofrenate type; body covered with long setae.

[5] Westwood (1848, p. 557) referred to the "spongilla insect" and Needham (1901, p. 560) subsequently suggested the common name of "spongilla flies." They have also been called "sponge flies."

TABLE 6.—*Records of parasites attacking Sisyridae*

Prey	Stage attacked	Parasite	Reference
Sisyra vicaria (Walker)	prepupae or pupae in cocoons	*Eupteromalus* sp. (Hymenoptera, Pteromalidae)	Spangler, 1952–1953, in litt.*
		Tetrastichus sp. (Hymenoptera, Eulophidae)	Ibid.
Sisyra fuscata (Fabricius)	prepupae mainly, a few pupae	white mold (fungus)	Killington, 1933, p. 85; 1936, pp. 173, 175 Withycombe, 1923, p. 523
		Eupteromalus sp. (Hymenoptera, Pteromalidae)	Killington, 1933, p. 88
		Hymenopteron	Withycombe, 1923, p. 523
Sisyra terminalis Curtis	prepupae, pupae	white mold (fungus)	Ibid.
		Hymenopteron	Ibid.
Sisyra	prepupae	hymenopterous parasite	Withycombe, 1923, p. 590
Sisyra and *Climacia*	cocoons	Hymenopteron	Old, 1933, p. 682
Climacia areolaris (Hagen)	eggs	fungus	Brown, 1952, p. 156
	larvae	"sewage fungus" in lab (possibly bacterial in nature)	Ibid.
	pupae	fungus	Brown, 1952, p. 157
	prepupae or pupae in cocoons	*Sisyridivora cavigena* Gahan (Hymenoptera, Pteromalidae)	Brown, 1951, pp. 103–110; 1952, p. 156 Gahan, 1951, pp. 100–102

*Of approximately 45 cocoons of mainly *Sisyra vicaria* (Walker) collected by Dr. Spangler in Nigger Creek at Mullet Lake, Cheboygan County, Mich., on July 30, 1952, at least 25 were parasitized by *Eupteromalus* sp. and one by *Tetrastichus* sp. The cocoons were collected within an area of about 20 sq. yds., mostly from the tops of *Scirpus* and *Eleocharis* stems (a few about 6 in. above the water line, some adjacent to gyrinid cocoons). In some instances a blackish mold appeared to have invaded the cocoons.

The adults of the Sisyridae can be distinguished from the Hemerobiidae as follows: In the Sisyridae, the forewing shows branches of Rs arising from a single Rs stem, whereas in the Hemerobiidae, the forewing shows two or more branches of R1 arising from the apparently fused stems of R1 and Rs. The adults of the Osmylidae are so different from the Sisyridae in appearance that there is no difficulty in distinguishing them, although the larvae are closely related. The osmylid adult is larger, possesses three ocelli on the vertex, has a

prothorax which is longer than wide, and has more numerous crossveins and branches to Rs in the wings.

HEAD (fig. 8,A,I): Antennae (fig. 7,C,F) arising mesad of compound eyes and articulated to single antennal sclerite on lateral side of each socket, scape enlarged, pedicel smaller than scape and only slightly

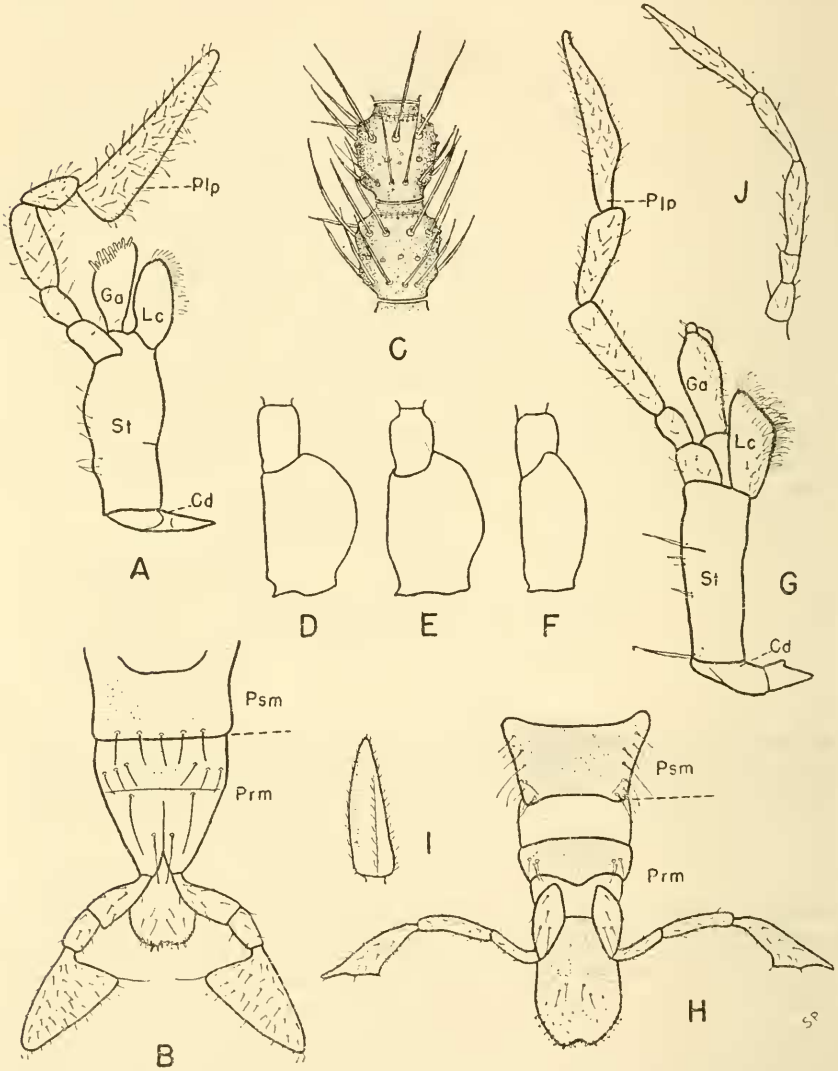

FIGURE 7.—Head appendages. A, *Sisyra vicaria* (Walker), maxilla with palpus; B, same, labium, ventral view; C, same, antennal segments eight and nine; D, same, basal antennal segment; E, *S. fuscata* (Fabricius), basal antennal segment; F, *S. apicalis* Banks, basal antennal segment; G, *Climacia areolaris* (Hagen), maxilla with palpus; H, same, labium, ventral view; I, *Sisyrina nirvana* Banks, terminal segment of maxillary palpus; J, *Neurorthus fallax* (Rambur), maxillary palpus. Abbreviations: Cd, cardo; Ga, galea; Lc, lacinia; Plp, palpus; Prm, prementum; Psm, postmentum; St, stipes.

larger than segments of flagellum (number variable, from about 40–70 segments, terminal segment more ovate with acute apex); vertex arched dorsally, with coronal or midcranial sulcus running from posterior margin of head to midvertex more pronounced in certain species (as *Sisyra vicaria*, fig. 9,A); postgena fused with gena, and postocciput fused with occiput; frons separated from genae laterally by the frontal sutures and anteriorly from the clypeus by the frontoclypeal sulcus or "suture," with frontal pits located at anterior ends of frontal suture; clypeus transverse, almost straight (*Sisyra*) or emarginate anteriorly, bearing setae; labrum (fig. 9,C,D) transverse, usually shorter than clypeus, almost straight, slightly rounded or emarginate anteriorly, lateral margins reaching posteriorly below anteclypeus, with setae, lower surface with one or two minute sensory groups; mandibles (fig. 9,E–H) asymmetrical, acute apically, outer margin convex, inner margin concave with left mandible usually having a more prominent subapical toothlike projection than the right, above which may be a row of short stout setae or small group of bristles on inner surface of each mandible, each mandible with condyle for articulation with postgena; maxillae (fig. 7,G,I,J) consisting of cardo (flexed mesally, with internal, oblique, strengthening ridge), stipes with 5-segmented maxillary palpus (the terminal segment largest and of distinctive shape in various genera), a heavily setose external galea and mesal lacinia; labium (fig. 7,B–H) consisting of the postmentum (somewhat concave posteriorly, slightly narrowed anteriorly), prementum (large, sometimes differentiated into posterior and anterior premental plates) with an anterior broad membranous ligula (notched slightly mesoanteriorly and covered with setae and sensory bristles) and 3-segmented labial palpus (third segment varied in shape in different genera); gular region membranous, transparent; labium and hypopharynx closely associated.

Thorax (fig. 8,B–E,J,K): Neck joining prothorax to head consisting of three pairs of sclerites—the precervicales (laterodorsal sclerites, small, situated just before anterior margin of pronotum), the laterocervicales (bent, with anterior portion running forward to unite with head), and the postcervicales (posterior to laterocervicales); prothorax with pronotum usually broader than long, sometimes with depressions, elevations, or grooves dorsally, sometimes overlapping the cervicales and dorsal portions of pleural sclerites (the epimeron and episternum, which are reduced and united to almost form a single plate, epimeron ventrally produced into a rounded process articulating with coxa), sternum mostly membranous except for a transverse basisternum between coxae, small trochantin just below ventral margin of episternum; mesothorax largest, mesonotum large, with scutum divided into two convex lobes by deep median sulcus

(suture), scutellum large, well developed, almost diamond shaped, with shield-shaped depression at apex, postscutellum with indication of median division; metanotum with anterior median depressed area, scutum almost divided into two, sometimes irregularly shaped lobes, shorter medially than mesoscutum, scutellum triangle shaped, smaller than that of mesoscutum with almost straight posterior margin, postscutellum almost hidden; pleura of both mesothorax and metathorax similar, the episternum divided into the anepisternum and katepisternum, separated by the pleural suture from the elongate epimeron; katepisternum with a small anteroventral trochantin; sternum of mesothorax and metathorax divided into two halves by a median longitudinal sulcus, the supraepisternum more medial, the infraepisternum more lateral.

Legs (fig. 8,F–H): Metathoracic pair longer than prothoracic or mesothoracic pair; coxae free, forecoxae cylindrical, widely separated, mesothoracic and metathoracic coxae more widely spaced, broader, more truncate (mesothoracic coxae slightly longer), divided into a larger anterior coxa vera and a much smaller posterior basal meron; trochanters short, entire; femora elongate and cylindrical; tibiae slightly narrower basally and distally, of a length almost equal to or shorter than that of the femora in the prothoracic and mesothoracic legs, posterior tibiae almost 1½ times the length of the femora; one spur on distal end of prothoracic tibiae and two on distal ends of mesothoracic and metathoracic tibiae; tarsi 5-segmented, the metatarsus (first segment) the longest, the fourth the shortest (*Sisyra*, *Climacia*), the fifth bearing a pair of strongly curved, simple claws, with a broad ventral padlike setose empodium between.

Wings (figs. 10, 11): The wing venation terminology used in this revision is basically that of Martynov (1928, pp. 89–91) and Carpenter (1940, pp. 253–256). These investigators, along with Tillyard in his later views (1932, p. 29), and probably Lameere (1922, pp. 138–149), hold to the theory of the basal fusion or coalescence of MA with Rs, thus making MA what Killington (1936, p. 29) and Comstock (1918, p. 178) consider R5 without the fusion. Killington maintains that the base of M lies so close to R that there is difficulty in distinguishing these veins, and that R and M may be readily separated by a fold in the membrane between them. Like Comstock, he divided the media into M1, M2, M3, and M4 (corresponding veins considered branches of MP by Martynov and Carpenter). Carpenter (1940, pp. 194, 253) mentions that the free basal piece of MA—the faint, obliquely transverse vein appearing at the base of M just before it coalesces with R in the forewings of many Hemerobiidae and related families—is usually absent in the Sisyridae, in which family Rs arises near the base of the wing and coalesces with MA for a short

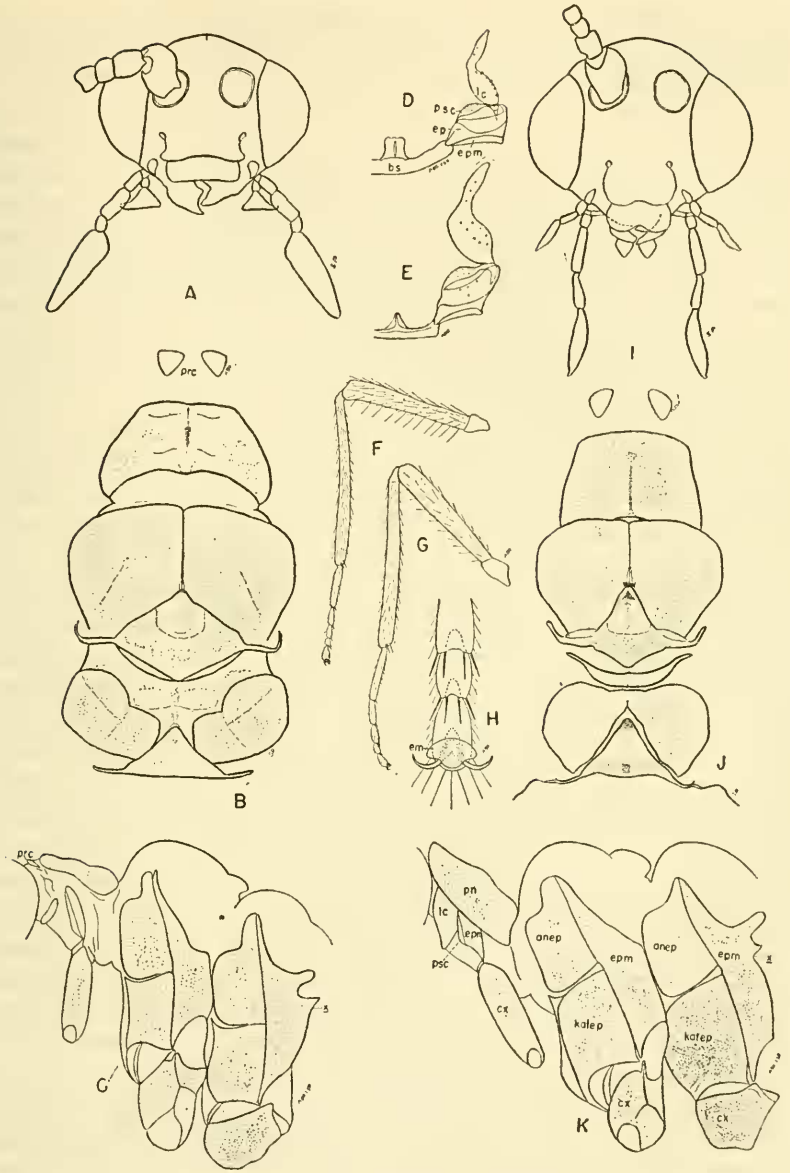

FIGURE 8.—Head and thorax of *Sisyra vicaria* (Walker), A–D, F, H, and *Climacia areolaris* (Hagen), E, G, I–K. *Sisyra vicaria:* A, head, anterior view; B, thorax, including precervicales of neck, dorsal view; C, thorax, lateral view; D, basisternite, from interior; F, metathoracic leg, cephalic face; H, terminal tarsal segments of metathoracic leg. *Climacia areolaris:* E, basisternite, from interior; G, metathoracic leg, cephalic face; I, head, anterior view; J, thorax, including precervicales of neck, dorsal view; K, thorax, lateral view. Abbreviations: anep, anepisternum; bs, basisternite; cx, coxa; em, empodium; ep, episternum; epm, epimeron; katep, katepisternum; lc, laterocervicale; pn, pronotum; prc, precervicale; psc, postcervicale; *x*, marking spot of indentation.

interval. Since the theory seems plausible, and in order to create less confusion with the identification of Nearctic Neuroptera, the principal features of Martynov's and Carpenter's terminology are used in this paper.

The labeling of some of the veins in this paper is provisional, but is done in order to facilitate the definition of a genus or species. Variations and abnormalities in the wing venation are frequently seen in the following: gradates in the "doubling" of certain cross-veins where a second is found adjacent to the normal one, the occasional absence of a cross-vein usually present, or addition of one not normally present; the relatively basal or distal position of a cross-vein; the direction of the cross-vein; the forking of a longitudinal vein far basad or distad of its usual point of forking; the addition of branches of longitudinal veins to the margin; and the difference of venation seen in the two wings of the same specimen. Color and size variations can also occur. The unstable nature of the veins should be taken into consideration when venation is used for the determination of a species.

The vague definition ascribed to the term "gradate veins" has also led to confusion. Gradate veins are supposed to run obliquely across the wing, usually in the distal half, and more or less parallel with the outer margin. Or, in the sense of Bradley (1939, p. 36), gradate veins are a series of cross-veins alternating with parts of longitudinal veins, forming a regular zigzag line across the wing. In this paper, those cross-veins considered gradates are those other than the basal series (as 1st r, basal m between MA and MP1+2, 1st m between MA and MP1+2 (M5 of Tillyard, 1919, p. 533), 1st and 2d m-cu between MP and Cu, cubital, cubito-anal and anal cross-veins). Specifically, the shorter inner gradate series will include 2d r, basal s, 1st r-m, 2d m between MA and MP1+2, 1st m between MP1+2 and MP3+4, and the usually longer outer gradate series, including 3d r, distal s, 2d r-m, 3d m between MA and MP1+2, m between MP1+2 and MP3+4, and 3d m-cu, when present.

A trichosor consists of a thickening of the membrane upon which stand several macrotrichia, somewhat elongate in form along the apical portion of the margin but becoming shorter and smaller towards the bases of the inner and costal margins, as of Killington (1936, pp. 34–35), or the marginal "dots and dashes" of Comstock (1918, p. 167). Thyridia—in the sense of a weakening of the vein because superposed by a concave fold or in the sense of small whitish or almost transparent spots, or the "bullae" of Comstock (1918, p. 81)—can be seen in the forewing at the point where MP forks basally, on the cubito-anal and anal cross-veins in the forewing, on the medial cross-vein, and on the radial, medial, and mediocubital cross-veins of the outer

gradates in the hindwing when they occur. The coupling apparatus consists of a convex jugal lobe on the forewing and a poorly developed humeral lobe bearing two bristles on the hindwing. In general, the costal cross-veins tend to be closer together toward the base of the wing.

A question which has arisen all through this investigation has been whether Sc and R1 are actually fused or coalesced distally before the pterostigma in all genera of the family. The original diagnoses of the family, as given by Handlirsch (1906, pp. 40–42; 1908, pp. 1251, 1292) do not mention the fusion as a characteristic of the family, although Tillyard (1916, p. 312; 1926, p. 316), Comstock (1918, p. 177), and Carpenter (1940, pp. 194, 253) state that the fusion does take place. Krüger (1923) has noted a difference in this point in regard to the different genera. In the present study of the wings of the four genera (*Sisyra*, *Climacia*, *Neurorthus*, *Sisyrina*) there did appear to be a definite fusion in *Climacia*, but in *Sisyra* and particularly *Neurorthus* there was some doubt (e. g., in a single specimen of *Sisyra*, one wing might appear to show Sc and R1 fused, but the other might show them running free to the margin; or in certain species, as *panama*, Sc appears weak at the margin). In *Neurorthus*, Sc gives the appearance of being free at the apex and joined to R1 by a short subcostal cross-vein. In the specimen of *Sisyrina* examined, Sc seemed to atrophy at the apex. The terminal fork of R1 at the end of the pterostigma is weak, as are also the pterostigmal cross-veins in all genera.

Abdomen (fig. 12): 10-segmented; a pair of spiracles on each of first eight segments, the first pair the largest, closest to anterior margin, the other pairs smaller, located less anteriorly; first segment short, sternite and tergite reduced, only small sclerotized lateral pieces, rest membranous; second and third tergites usually small, second and third sternites usually larger than fourth to seventh tergites in the female and to eighth in the male, which are more uniform; transverse streaks ("secondary sutures" of Killington, 1936, p. 36) or sulci (for strengthening) present on second and third sternites, sometimes on fourth to sixth sternites, varying in stage of development, usually becoming shorter and weaker more distally, on second segment curved toward anterior margin.

Genital segments of male varying considerably in shape and size in different genera; ninth tergite divided or greatly weakened middorsally, sometimes moved lateroventrally to tenth tergite and much smaller and more difficult to see (*Sisyra*), almost fused with it (*S. minuta*), larger and almost as broad as tenth tergite (*Climacia*); ninth sternite located below ninth tergite, ventrally more or less convex, and with a pair of internal distally projecting processes (*Climacia*), or larger, more like eighth sternite (*Sisyra*); tenth tergite

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(two united epiprocts of Tjeder, 1954, p. 32) weak middorsally, bearing long setae, broad and of distinctive shape (*Climacia*), or a small, transverse band bearing a small group of trichobothria, and with long setae (*Sisyra*); tenth sternite almost striplike, posterior and posteroventral to tenth tergite, bearing long setae and broadening ventrally (*Climacia*) or moved dorsally and divided into a basal plate (gonarcus of Tjeder, ibid., p. 28) and a distal pair of claspers (entoprocessus of Tjeder, ibid., p. 30) (*Sisyra*); internal genital armature reduced; parameres between lateral halves of ninth and tenth tergites and above ninth sternite partially fused (*Climacia*) or free in the form of two sclerotized rods below basal plate (*Sisyra*); small, thin, V-shaped, keellike, transparent internal hypandrium present usually above eighth sternite and proximal portion of ninth sternite (*Sisyra*, similar to that of *Hemerobius*) (fig. 13,A,D).

Abdomen of female with first seven segments similar to those of male; genital tergites and sternites more similar in different genera and species in general than those of male, eighth tergite usually considerably developed laterally, broken middorsally and most often appearing fused midventrally (uncertain in *Sisyra panama*, *Sisyrina*) resembling a sternite, eighth pair of spiracles opening in the tergite; eighth sternite greatly reduced to a minute subgenital plate lying ventral to genital opening and between and ventral to bases of lateral halves of ninth tergite, called the gonapophyses (Killington, 1936, p. 64) with two elongate, lateral, posteriorly directed processes (fig. 24,B); ninth tergite divided into two large plates, moved lateroventrally to tenth tergite, with one or two thickened ridges or apodemes (usually posterior only, but both anterior and posterior present in *Sisyra vicaria*) for articulation with ninth sternite; ninth sternite elongate, movable, divided, attached ventrally to articulation ridge of ninth tergite, apex acute; tenth tergite entire, sometimes weakened middorsally, a transverse plate with a group of trichobothria, similar to that of male; genital pore located ventrally between the lateroventral halves of the ninth tergite.

The anus opens between the lateral portions of tenth tergite in the male, and in membrane just beyond tenth tergite in the female. The cement gland is long and oval with a short, slightly swollen duct in the female. In the male, the testes are fused and enclosed in one yellow oval scrotum (the shape sometimes varying) as in *Osmylus* (Withycombe, 1923, p. 524; 1925, p. 388), with the two vasa efferenti coming off from this ventrally at about the middle, or somewhat posteriorly. Vesiculae seminales are large and considerably lobate, but of a slightly different form from those of *Osmylus*. The remaining anatomy is of a neuropterous type in general.

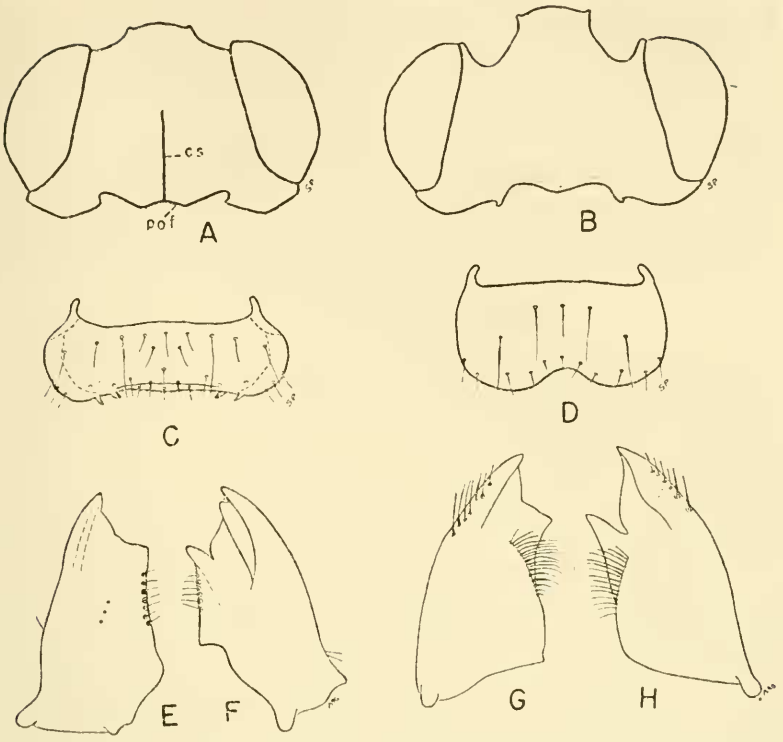

FIGURE 9.—Head and mouthparts of *Sisyra vicaria* (Walker), A, C, E, F, and *Climacia areolaris* (Hagen), B, D, G, H. A, B, posterior view of head, showing cranial sulcus (cs) and postoccipital margin of foramen (pof); C, D, labrum; E, G, right mandible, ventral view; F, H, left mandible, ventral view.

Key to the genera of Sisyridae

1. A series of outer gradate cross-veins present in fore- and hindwings . . . 2
   No series of outer gradate cross-veins present in either wing 4
2. Rs of fore- and hindwings usually with one main fork under or slightly basad of pterostigma; forewing with 3d A running into and uniting with 2d A near margin (North, Central, and South America) (p. 480).
   Climacia McLachlan
   Rs of fore- and hindwings usually with two main forks, both basad of pterostigma; forewing with 3d A not fusing with 2d A, but running to margin 3
3. Forewing usually with well-developed inner gradate series of 4–6 cross-veins below 2d r; Sc appearing to run free to margin, joined by a cross-vein to R1 (*Rophalis* Hagen, fossil in Baltic amber, p. 522). (Algeria, Australia, Balearic Islands, Bulgaria, Corsica, Italy, Japan, Sardinia, Sicily, Spain) (p. 520). . . . . **Neurorthus** Costa
   Forewing usually with poorly developed inner gradate series of only two or three cross-veins; Sc indistinct in pterostigma (Southern India) (p. 517).
   Sisyrina Banks

4. Forewing with Sc appearing separate from R1 or to atrophy in pterostigma (Japan) (p. 518). . . . . **Sisyrella** Banks
Forewing with Sc appearing to run into R1 or to be joined by a cross-vein, not atrophying in pterostigma (cosmopolitan) (p. 456). . . **Sisyra** Burmeister

NOTE: The status of three genera is not yet settled. Examination of the genotype of *Sisyrella* may disclose stronger characters for separating *Sisyra* and *Sisyrella*; however, *Sisyrella* appears to be a weak genus and perhaps is not distinct from *Sisyra* (see p. 519). The possibility of the synonymy of *Rophalis* and *Neurorthus* also has not been fully investigated (see p. 521).

Genus *Sisyra* Burmeister

Sisyra Burmeister, 1839, p. 975.—Banks, 1905, p. 25.—Navás, 1935, p. 40.—Killington, 1936, p. 228.—Carpenter, 1940, p. 253.

Brownish spongilla-flies.

GENOTYPE: *Hemerobius fuscatus* Fabricius (by subsequent designation by Banks (1905, p. 25)).

HEAD (figs. 7,A–F; 8,A; 9,A,C,E,F): Antennae with approximately 35–50 segments, two whorls of setae on all but first or basal segment, on which the setae are irregularly arranged; face shorter than in *Climacia*, clypeus and labrum with anterior margins almost straight, labrum approximately 3½ times as broad as long, setose, and with anterior projections on both sides of center; postoccipital margin of foramen concave in center with two lateral convexities; median sulcus sometimes pronounced; maxillary palpi sometimes with first, second, and fourth segments shorter than the third (which is approximately 1½–2 times as long) and the fifth or terminal segment, which is almost twice as long as the third, broadest at base, narrowed and tapered to a point at apex; labium (fig. 7,B) with postmentum and prementum closely adjoined, at times prementum almost appearing divided into anterior and posterior plates, but differing from *Climacia*, which shows a distinct membrane between the postmentum and prementum, and another distinct membrane between the anterior and posterior plates of the prementum; labial palpi with third or terminal segment greatly enlarged, flattened, triangle shaped and very wide at base, the second small and subcylindrical, the first approximately 1½–2 times the length of the second, and narrowed proximally.

THORAX (fig. 8,B–D): Pronotum shorter, smaller, and more furrowed than in *Climacia*; bases of setae on laterocervicales stouter than in *Climacia*; median projection of basisternite quadrate; posterior margin of metepimeron with caudal indentation (*x*, fig. 8,C) less pronounced than in *Climacia;* mesonotum and metanotum with scutellum having a broader apex than and mesoscutellum with posterior lateral margins of apical shield-shaped depression longer than in *Climacia*; metascutum with halves more irregular and metanotum with center more depressed than in *Climacia*.

Legs (fig. 8,f,h): Tibiae cylindrical, first tarsal segment the longest, particularly in metathoracic legs, where it is more than one-third the length of tarsus, fourth the shortest.

Forewing (fig. 10,a): Costal area with approximately 11–16 costal cross-veins before pterostigma; subcostal area usually slightly narrower than the greatest width of costal area, with one basal subcostal cross-vein usually present below about the fourth to sixth costal cross-veins, and sometimes one appearing to be present distally connecting Sc to R1; coalescence of Sc with R1 at apex of wing below the pterostigma uncertain, sometimes Sc appearing to atrophy at the apex; Rs+MA separating off from R1 near base, Rs separating from MA slightly basad of 1st r; free stem of Rs with two main forks, R4+5 separating off at about longitudinal midpoint of wing, R2 and R3 forking a short distance beyond; MA usually dividing into two branches slightly basad (occasionally distad) of level of junction of Sc and R1; MP forking into MP1+2 and MP3+4 a short distance beyond separation of Rs from MA; MP1+2 and MP3+4 with terminal fork usually basad of level of junction of Sc and R1; Cu1 separating from Cu2 near base of wing; 1st and 3d A sometimes, and 2d A usually, with marginal forking, 3d A running free to margin; two or three radial cross-veins between R1 and Rs; one radiomedial cross-vein between Rs or R4+5 and MA, usually at base of R4+5; one medial cross-vein between MA and MP1+2; three mediocubital cross-veins between MP and MP3+4 and Cu1, the first basal, the second to Cu1 before branches, and third to branches; one cubital cross-vein between Cu1 and Cu2; one basal cubito-anal cross-vein between Cu2 and 1st A; one anal cross-vein between 1st and 2d A; no real gradates, inner series usually of two cross-veins (three in *panama*), 2d r and 1st r-m.

Hindwing (fig. 10,b): Costal area with approximately 9–12 costal cross-veins before pterostigma; subcostal area broader with an indistinct basal subcostal cross-vein; Sc usually appearing to be coalesced with R1 at apex; Rs after branching off from R1 near base, continuing free for a shorter distance than in *Climacia*, then coalescing with and finally separating from MA close to the longitudinal midpoint of wing, then proceeding anteriorly back toward R1, forking into two main forks, R4+5 near center of wing, and, a short distance beyond, R2 and R3, basad of pterostigma; MA separating off from MP closer to base than in *Climacia* into a free sinuate section, which curves toward and coalesces with Rs, then separates and forks at margin; MP forking into MP1+2 and MP3+4 usually basad of point of separation of Rs from MA; MP1+2 usually with terminal fork basad of level of point of coalescence of Sc and R1; Cu1 separating from Cu2 near base of wing; 1st A usually simple, 2d A usually with marginal forking; one or two radial cross-veins, the first distad of forking of R2 and R3,

the second below pterostigma, when present; one medial cross-vein between MA and MP1+2 slightly distad of separation of MA from Rs; one mediocubital cross-vein, usually connecting lower branch of MP3+4 to a terminal branch of Cu1, one cubito-anal cross-vein between Cu2 and 1st A near base; one anal between 1st and 2d A

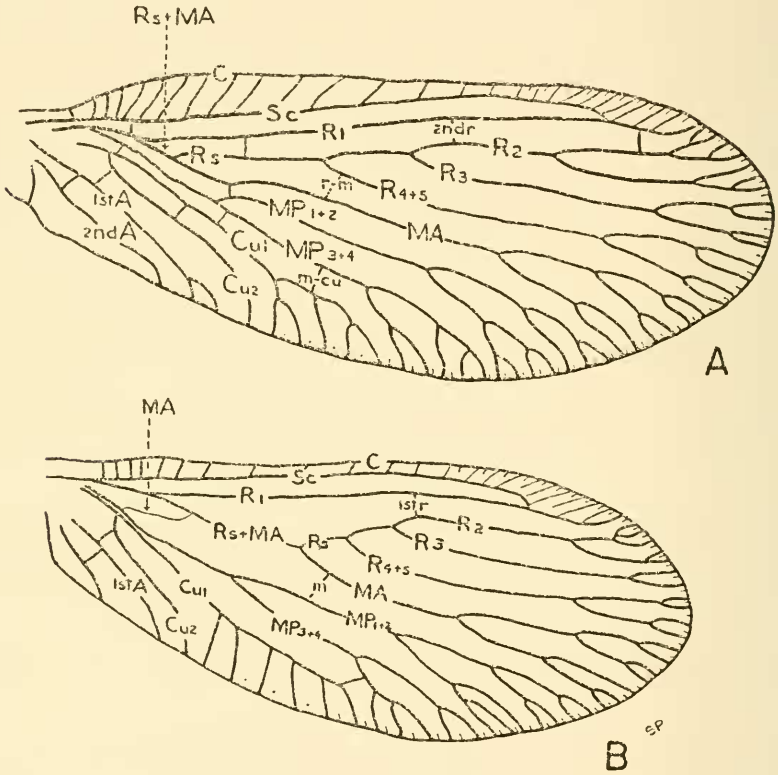

FIGURE 10.—Wing venation of *Sisyra vicaria* (Walker). A, forewing; B, hindwing. Abbreviations: C, costa; Sc, subcosta; R1, radius; R2, R3, and R4+5, branches of radial sector; Rs+Ma, radial sector and anterior media coalesced; MA, anterior media; MP1+2 and MP3+4, branches of posterior media; Cu1 and Cu2, branches of cubitus; A, anal vein; r, radial cross-vein; r-m, radiomedial cross-vein; m, medial cross-vein; m-cu, mediocubital cross-vein.

near base; no outer gradates, inner series of two cross-veins, 1st r and 1st r-m; thyridia apparent on 1st r-m.

MALE GENITALIA (fig. 14,A,B): Eighth tergite sometimes appearing divided into two dorsal plates; ninth tergite divided into two small parts, each half moved lateroventrally to tenth tergite; tenth tergite entire, broader than long, frequently shorter dorsomedially, large, with long setae and a group of from two to nine trichobothria on each side; ninth sternite large and appearing terminal ventrally, ventral to

ninth and tenth tergites; tenth sternite moved dorsally to a position posterior to tenth tergite and divided into an anterior transverse plate and a posterior pair of more heavily sclerotized claspers furnished with one or more dentate projections; two small heavily sclerotized parameres arising caudally below basal plate of tenth sternite, diverging and attached posteriorly to claspers.

Female genitalia (fig. 14,c): Ninth tergite, the largest, divided in two, each part moved lateroventrally to the tenth tergite and of distinctive shape in the species, usually sloping posteroventrally to just before articulation point with ninth sternite, where there is a sharper slope; tenth tergite entire, transverse, frequently shorter dorsomedially, with group of trichobothria on each side; ninth sternite divided into two elongate movable upturned parts acute apically, tapering and bent posteriorly just before apex, with small narrow ventral projection, each articulated at base with posterior, more heavily sclerotized ridge of each half of ninth tergite; tenth sternite not yet accounted for and a morphological study is necessary.

Basal abdominal segments: Second tergite usually appearing as a row of setae; third tergite shorter medially so as to appear almost divided (*vicaria, fuscata*) or appearing as a row of setae (*apicalis, minuta*); fourth rectangular to oval (*fuscata, minuta*) or almost divided in two (*vicaria, apicalis*); sixth and seventh larger, more oval than second to fifth. Second and third sternites large, close together, with each half of dark streak beginning in posterolateral corners and running anteriorly to meet near anterior margin (a median dark point near concave anterior margin in *apicalis*, from which two short streaks diverge); third to fifth sternites with transverse streaks almost parallel and closer to anterior margin, streak faint in fifth; sixth and seventh sternites shorter and more narrow; eighth narrowest of sternites; pair of pale spots near posterior margin of second to sixth sternites sometimes prominent (*vicaria, fuscata*).

The genus *Sisyra* is cosmopolitan and 23 named species have been taken and recorded from various regions of the world (table 7).

Key to the species of Sisyra in the Western Hemisphere

1. Forewing usually with three radial cross-veins, 5 to 7 mm. long and at least 2 mm. wide, membrane appearing more or less uniform light brown in color; basal antennal segment broad (fig. 7,d,e; pl. 1, figs. 2, 3) (*vicaria* group, p. 460) 2

   Forewing usually with two radial cross-veins, smaller, 3–5 mm. long and usually less than 2 mm. wide, membrane sometimes appearing more or less distinctly streaked with brown between longitudinal veins (except in *minuta*); basal antennal segment more slender, elongate (fig. 7,f; pl. 1, figs. 1, 4, 5) (*apicalis* group, p. 471) 3

2. Male claspers long, wide at base, then sharply curved and gradually narrowed to a terminal point, basal plate about one-third as long as claspers; lateroventral halves of ninth tergite of female more or less triangle shaped, rounded ventrally and with one prominent sclerotized articulation ridge posteriorly; forewing usually with R2 not forked deeply, i. e., basal to or at level of point of junction of Sc and R1, apex oval, symmetrical with respect to longitudinal axis of wing, approximately 5 mm. long and 2 mm. wide; vertex, frons, antennae and thorax blackish; basal antennal segment with sharp inner curve (figs. 7,E, 13; pl. 1, fig. 2) . . . . . **fuscata** (Fabricius) (p. 468)

Male claspers short, squat, basal plate approximately as long as claspers; lateroventral halves of ninth tergite of female elongate, with both anterior and posterior sclerotized articulation ridges; forewing with R2 usually forked basal to point of junction of Sc and R1, apex more acute, less symmetrical, frequently more than 5 mm. long and 2 mm. wide; vertex yellow to yellowish brown with thin dark line encircling basal antennal segments, frons and antennae yellow to yellowish brown, basal segments of antennae dark brown with remaining segments yellow or brown to midpoint and then yellowish to apex; basal segment more smoothly curved on inner margin (figs. 7,D, 10, 14; pl. 1, fig. 3) . . . . . **vicaria** (Walker) (p. 460)

3. Forewing with R1 bent at a strong angle at meeting point with Sc, then dipping and curving toward margin; membrane uniformly light brown, approximately 3.2 mm. long and 1.3 mm. wide; male claspers beaklike, sharply curved dorsoventrally to point; vertex and frons yellowish brown, antennae yellowish with basal two segments brown (fig. 15; pl. 1, fig. 6).
minuta Esben-Petersen (p. 478)

Forewing with R1 not bent at an angle at meeting point with Sc, although curved and dipping somewhat; membrane with distinct intervenational streaking between longitudinal veins (pl. 1, figs. 1, 4, 5) 4

4. Antennae brownish black for basal 17 segments (approximately), then pale yellowish for about 15 segments, and fuscous for 5 or 6 terminal segments; forewing 3.7 to 5 mm. long and approximately 1.7 mm. wide; lateroventral halves of ninth tergite of female small, ovate; male claspers long, narrow, smoothly curved, distally of more or less even width (fig. 16; pl. 1, fig. 1).
apicalis Banks (p. 471)

Antennae brown; forewing 3.8 to 4 mm. long, and approximately 1.4 mm. wide; lateroventral halves of ninth tergite of female "pear-shaped," elongate; male claspers stout, with long setae (fig. 17; pl. 1, fig. 4).
panama, new species (p. 474).

NOTE: Because of the discovery that the type of *nocturna* now consists only of a left forewing and right hindwing (both torn) which do not differ essentially from those of *apicalis* (r-m and s being variable to a certain extent), it is inadvisable to differentiate further between the two species here (see *nocturna*, p. 476, and *apicalis*, p. 471).

Sisyra vicaria (Walker)

FIGURE 14; PLATE 1, FIGURE 3

Hemerobius vicarius Walker, 1853, p. 297 (Georgia).
Sisyra vicaria Hagen, 1861, p. 197.—Banks, 1905, p. 25.—Carpenter, 1940, p. 254.
Sisyra umbrata Needham, 1901, p. 555, pl. 12 (figs. 6-8, 11), text figs. 33, 34b, 36 (Saranac Inn, N. Y.; Lake Forest, Ill.).—Banks, 1905, p. 25.

Head with vertex usually yellow, occasionally some brown, narrow median blackish streak over coronal sulcus from posterior margin to midvertex usually distinct, usually a narrow blackish ring around antennal sockets; face yellowish; palpi yellowish to brownish; basal two antennal segments usually brown, remaining segments yellowish to end or brown for 18 segments (approximately) and then yellowish to end (approximately 42–50 segments altogether); legs yellow with coxae brown and sometimes femora and tibiae with some brown; notum medium brown, pleura brown; abdomen brown.

Forewing (pl. 1, fig. 3): Average length female 5.5 mm., male 5.4 mm., average width female 2.4 mm., male 2.3 mm.; apex slightly asymmetrical with respect to longitudinal axis of wing; membrane more or less uniformly light brown (with occasionally a few indications of faint light brown streaks particularly near cubital and mediocubital areas toward inner margin); longitudinal and cross-veins brown; pterostigma slightly darker than membrane; R2 forked basad of or at level of junction of Sc and R1; R3 and R4+5 usually not forked as deeply from margin, although R4+5 sometimes with terminal fork near level of junction of Sc and R1; MP1+2 usually forking into two even branches to margin; Cu1 with three to five branches to margin; approximately 12–15 costal cross-veins before pterostigma; usually three radial cross-veins, 1st r above and usually near midpoint of free stem of Rs, 2d r above R2 near forking of R2 and R3, and 3d r below pterostigma to R2 or R2 terminal fork (in rare cases where fork is lacking); sometimes a 2d or even 3d (rarely) r–m present; marginal forking well-developed.

Hindwing (pl. 1, fig. 3): Average length female approximately 5 mm., male 4.6 mm., width female approximately 2.2 mm., male 2 mm.; membrane almost hyaline with pterostigma slightly darker brown than membrane; venation brown; R2, R3, and R4+5 usually with terminal forks distad of level of point of coalescence of Sc and R1; about three to seven branches of Cu1 to margin; two radial cross-veins, 1st r slightly distad of forking of R2 and R3 from Rs; 2d r to R2 or R2 fork under pterostigma near margin; marginal forking well developed.

Male genitalia (fig. 14,a,b): Eighth tergite with central portion short; two parts of ninth tergite small, more or less triangle shaped; tenth sternite with basal plate almost as long as claspers; claspers short, squat, curved, with sharp angular drop to terminal conical narrow portion, which is about one-third as wide as broad basal part of clasper, two setalike projections at end of each clasper; parameres "boot shaped."

Female genitalia (fig. 14,c): Eighth tergite longer just above spiracle, shorter just below spiracle, then lengthening ventrally;

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TABLE 7.—*Species of Sisyra in the world*

Zoogeographic Regions (Wallace)	Distribution	Species and original reference
Nearctic	North America	
	United States	*apicalis* Banks (1908, p. 261)
	United States; Canada; Alaska	*fuscata* (Fabricius) (1793, p. 84)
	United States; Canada	*vicaria* (Walker) (1853, p. 297)
Neotropical	West Indies	
	Cuba	*apicalis* Banks (1908, p. 261)
	Central America	
	Panamá	*apicalis* Banks (ibid.); *panama*, new sp.
	British Honduras	*nocturna* Navás (1932, p. 115)
	South America	
	Brazil	*minuta* Esben-Petersen (1935, p. 152)
Palaearctic	Europe	
	Austria, Belgium, British Isles, Finland, France, Germany, Netherlands, Norway, Russia, Sardinia, Sweden, Switzerland	*fuscata* (Fabricius) (1793, p. 84)
	Netherlands, Scandinavia to Spain and Portugal.	*dalii* (McLachlan) (1866, p. 268)
	Denmark, Finland, Germany	*jutlandica* Esben-Petersen (1915, p. 175)
	Belgium, British Isles, Netherlands, Scandinavia to Spain and eastward to Carpathians; doubtfully recorded from Upper Egypt by Esben-Petersen (1915, p. 84)*	*terminalis* Curtis (1854, p. 56)
	China	
	Chekiang, Chusan	*aurorae* Navás (1933, p. 13)
	Japan**	
	Kozuke Province	*ozenumana* Nakahara (1914, p. 495)
	Ohmi Province	*yamamurai* Nakahara (1914, p. 496)
Ethioplan	Africa	
	Cape Province; Natal	*afra* Kimmins (1935, p. 561)
	Madagascar	*radialis* Navás (1910, p. 80)
Oriental	India	
	Salsette Island	*aquavivai* Navás (1929a, p. 52)
		fasciata Navás (1930, p. 44)
	Calcutta	*indica* Needham (1909, p. 206)
	East Indies	
	Java	larva like *fuscata* (Esben-Petersen, 1933, p. 626)
	Philippine Islands	
	Luzon	*vigana* Navás (1923, p. 8)
		bakeri Banks (1913, p. 215)
Australian	Australia	
	Queensland	*brunnea* Banks (1909, p. 76)
	Queensland; Northern Territory	*punctata* Banks (1909, p. 77)
	New South Wales	*brunnea* var. *rufistigma* Tillyard (1916, p. 314)
	New South Wales	*turneri* Tillyard (1916, p. 314)
	North Australia	*esben-peterseni* Handschin (1935, p. 699)

*One specimen of *Sisyra* sp. near *terminalis* from the Sudan has been examined (in CNHM).

**If the genus *Sisyrella* proves to be a synonym of *Sisyra* upon further investigation, the species *japonica* Nakahara (1914, p. 493) from Osaka and *nikkoana* Nakahara (1911, p. 398) from near Tokyo might also be included here.

ninth tergite with each lateroventral half large, longitudinally elongate, with one anterior and one posterior articulation ridge, dorsoproximal margin shaped like a bird's head, dorsal border gradually sloped from proximal to distal border, ventral margin rounded.

LECTOTYPE: A male (pinned) from Georgia (John Abbot); BM; by present designation.

LECTOALLOTYPE: A female (pinned) with same data; BM; by present designation.

Carpenter (1940, p. 254) mentioned two cotypes from Georgia. Upon corresponding with D. E. Kimmins (BM), it was learned that the two specimens were male and female and the suggestion was made by Kimmins that the male be designated the lectotype. According to Kimmins, both are Abbot specimens and bear labels "with the word 'Type' within a green ring (the distinguishing mark of a Walker type), and a very small label 'Georgia.' "

Records [6] show that John Abbot (1751–183(9)?) came from England to Virginia in about 1773, and arrived in Georgia about 1776. Most of his life was spent in Burke, Screven, and Bulloch Counties, although some time was spent in Savannah. He resided for several years at Jacksonborough (which town disappeared before 1880) on Beaver Dam Creek, in Burke County, part of which in 1793 was combined with part of Effingham County to form Screven County. In 1806 Abbot was listed as a taxpayer in Savannah. In 1820 he lived in Bulloch County on the west side of the Ogeechee River (across from Screven County and about a day's journey by wagon from Savannah).

The type material of *umbrata* in the Cornell University collection was examined and found to be identical with *vicaria*. This species was described from specimens collected at Lake Forest, Ill., June 1899, and at Saranac Inn, N. Y., June 28 to July 16, 1900 (Needham, 1901, p. 555). Since Needham did not designate a type for *umbrata*, a male from Lake Forest, Ill., June 2, 1899, is here designated the lectotype; and a female, bearing the same data is designated the lectoallotype. Lectoparatypes are designated as follows: 2 specimens (June 27, 1899), 1 wing (June 29, 1899) from Lake Forest, Ill., and 225 specimens (July 9, 1900) from Saranac Inn, N. Y. Topotypes from Lake Forest, Ill., include 2 larvae (July 2, 1899) and 60 specimens (July 4, 1900), "hatchery ceiling." Other vials containing specimens of *umbrata* which may have originally been type material are not included because of insufficient data.

In the Museum of Comparative Zoology there are two specimens (on the same pin) from Saranac Inn, N. Y., Aug. 8, 1900 ("cotypes," Carpenter, 1940, p. 255). These were examined and one (a male)

[6] Bassett, Auk, vol. 55, pp. 244-254, 1938; Dow, Journ. N. Y. Ent. Soc., vol. 22, pp. 65-72, 1914; Allen, Trans. Amer. Phil. Soc., new ser., vol. 41, pp. 543-549, 1951.

was found to be *fuscata*, the other is a *vicaria*. Since the date does not fall within the dates published by Needham, the specimen of *vicaria* is here designated a topotype of *umbrata*. It is not surprising that one *fuscata* among hundreds of *umbrata* types should be overlooked. The "cotype" of *umbrata* from Mosholu, N. Y., mentioned by Banks (1905, p. 25) was not found labeled as a "cotype," but a specimen of *vicaria* from this locality was seen in the collection of the Museum of Comparative Zoology.

DISTRIBUTION (specimens examined): *United States:* Arizona. District of Columbia. Florida: Alachua County; Jacksonville; Paradise Key. Georgia: Dalton (7 miles south of Swamp Creek); Gordon;

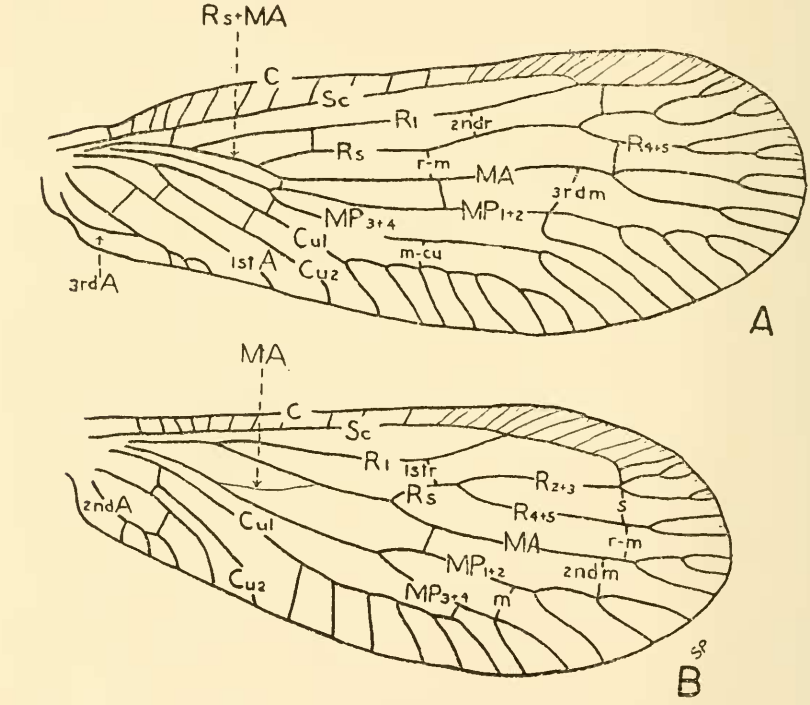

FIGURE 11.—Wing venation of *Climacia areolaris* (Hagen). A, forewing; B, hindwing. Abbreviations as in figure 10.

Okefenokee Swamp (Billy's Island). Illinois: Danville; Dunes Park; Karnak (Horseshoe Lake); Lake Forest; Mason County (Matanzas Lake); North Chicago; Roseerans (Des Plaines River); Winnetka. Indiana: Shelby (around bayou of Kankakee River). Kansas: Hodgeman County. Kentucky: Carter County; Harlan County; Nolansburg. Maine: Augusta; Camp Colby; Chesuncook; Houlton; Jackman; Kokadjo; Millinocket; Oquossoc; Patten; Princeton; Seboomook; Tim Pond. Maryland: Cabin John; Great Falls; High

Island. Massachusetts: Holliston; Mount Toby; Revere Beach. Michigan: Ann Arbor; Cheboygan County (Burt Lake; Douglas Lake; Mullet Lake; Nigger Creek); Livingston County (E. S. George Reserve). Minnesota: Browns Valley; Cass County; Crookston; Florian (Tamarac River); Hallock; Isle; Itasca Park; Marshall County; Stephen (Tamarac River). New York: Canajoharie; Canadarago Lake; Hamburg; Herkimer; Ithaca; Long Island (Calverton and

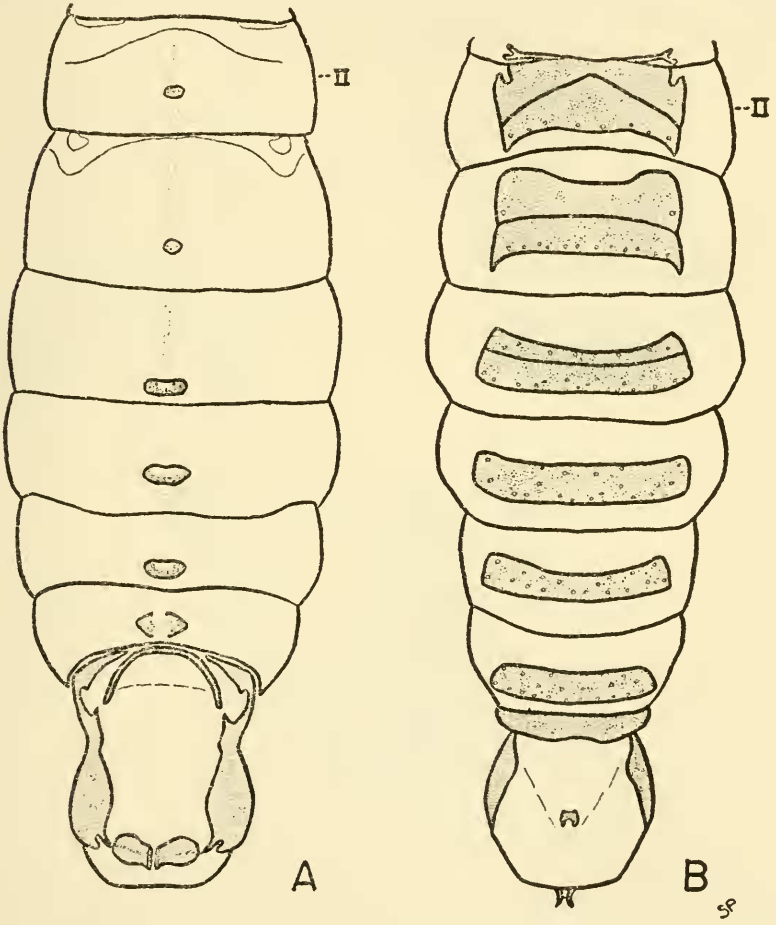

FIGURE 12.—Abdomen of *Climacia areolaris* (Hagen), female. A, dorsal view; B, ventral view.

Riverhead); Milford Center; Millwood; Mosholu; Mount Marcy (Heart Lake, altitude 2,150 ft.); Otsego Lake; Saranac Inn; Spencer; Sport Island (Sacandaga River); Sprakers; Tompkins County (McLean Bogs Reserve); Westchester County. Oklahoma: Albion. Oregon: Gold Hill. Rhode Island: Westerly. Tennessee: Clarksville. Texas: Colorado County; Hunt (Guadalupe River); San An-

tonio. Virginia: Great Falls. Washington: Chattaroy (Little Spokane River). Wisconsin: Boulder Junction (Nanotowish River below Boulder Lake); Trout River. *Canada:* British Columbia: Kaslo (Lilypad Lake); Lillooet (Seton Lake); Sardis (Cultus Lake). Nova Scotia: Annapolis Royal. Ontario: Biscotasing; Lake Muskoka; Ottawa; Rideau River (Black Rapids). Quebec: Knowlton; Lacolle.

The specimens examined were collected from April 9 to October 7. *S. vicaria* is the most common Nearctic species of *Sisyra*, although from the region west of the Rocky Mountains there are records only from Arizona, Oregon, Washington, and British Columbia.

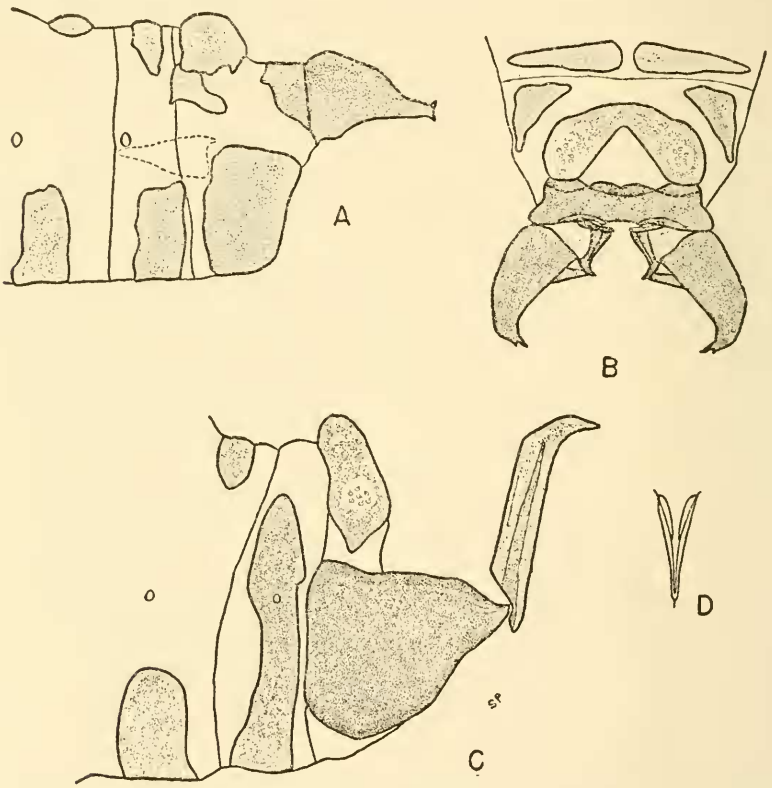

FIGURE 13.—Terminal abdominal segments of *Sisyra fuscata* (Fabricius). A, male, lateral view; B, male, dorsal view; C, female, lateral view; D, male, hypandrium.

S. vicaria and *S. fuscata* have been noted to coexist in the following localities: Augusta, Maine; Douglas Lake and Livingston County (E. S. George Reserve), Mich.; Cass County and Itasca Park, Minn.; Milford Center and Saranac Inn, N. Y.; and Biscotasing, Ontario. *S. vicaria* and *S. apicalis* have been taken from Paradise Key (Royal Palm State Park), Fla.

Specimens recorded as *vicaria* but which were not examined include those recorded by Carpenter (1940, p. 254) from North Carolina

(Raleigh) and Pennsylvania, and by Spencer (1942, p. 26) from Agassiz, British Columbia. Records for *vicaria* from localities from which specimens of *fuscata* have been examined include those by Banks (1905, p. 25) from Detroit, Mich., and by Carpenter (loc. cit.) from Kaslo, British Columbia; Go Home Bay, Ontario; and Detroit, Mich.

S. vicaria is readily distinguished from both *fuscata* and *apicalis* (with which it has been confused in North America) by the genitalia, larger size, color, and the usual position of the R2 terminal fork basad

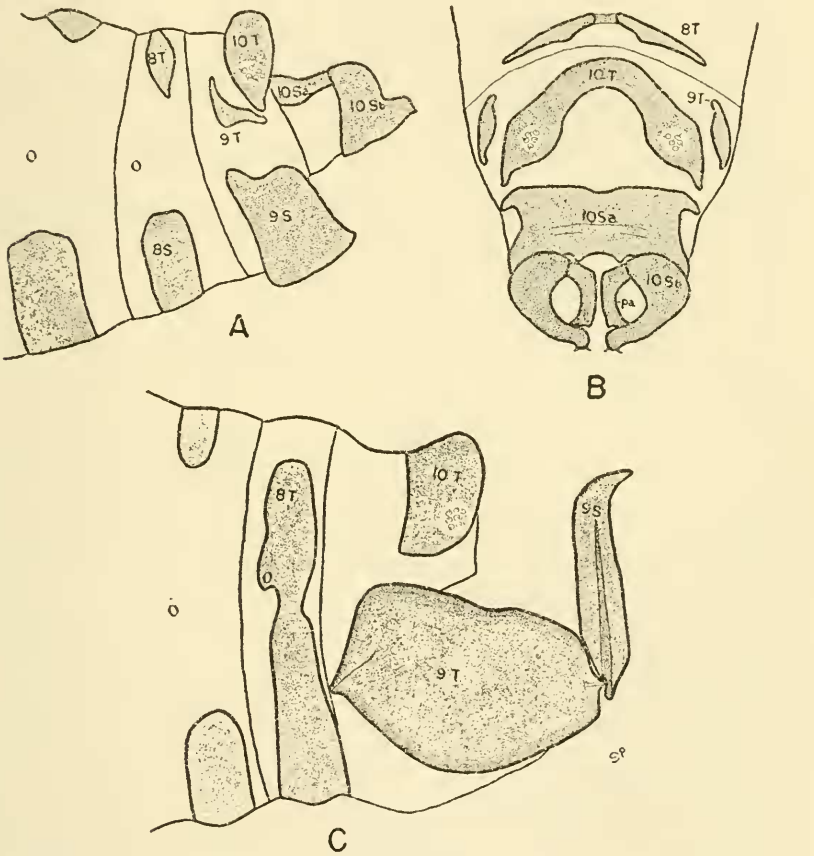

FIGURE 14.—Terminal abdominal segments of *Sisyra vicaria* (Walker). A, male, lateral view; B, same, dorsal view; C, female, lateral view. Abbreviations: pa, paremeres; S, sternite; Sa, anterior plate of sternite; Sb, claspers; T, tergite.

of the level of junction of Sc and R1 (in over 95 percent of specimens examined) in the forewing. It is also separated from *fuscata* through the more asymmetrical apex of the forewing, and from *apicalis* by the comparative lack of longitudinal intervenational streaking and the possession of 3d r in the forewing and 2d r in the hindwing.

Sisyra fuscata (Fabricius)

FIGURE 13; PLATE 1, FIGURE 2

Hemerobius fuscatus Fabricius, 1793, p. 84 (Denmark).—Stephens, 1836, p. 114, pl. 30, fig. 4.—Walker, 1853, p. 296.
Hemerobius nitidulus Stephens (not Fabricius), 1836, p. 114 (England).—Hagen, 1858, p. 25.
Hemerobius confinis Stephens, 1836, p. 115 (England).—Hagen, 1858, p. 25.
Sisyra fuscata Burmeister, 1839, p. 976.—Wesmael, 1841, p. 213.—Hagen, 1858, p. 25.—McLachlan, 1868, p. 167.—Navás, 1935, p. 43.—Killington, 1936, p. 230.
Sisyra fuscata var. *nigripennis* Navás, 1935, p. 44.
Sisyra morio Burmeister, 1839, p. 976 (Germany).—Hagen, 1866, p. 460.
Sisyra nigripennis Wesmael, 1841, p. 213 (Belgium).—Hagen, 1866, p. 460.
Branchiotoma spongillae Westwood, 1842, p. 105, pl. 8 (larva only).—Hagen, 1851, pp. 185–186; 1866, p. 388.
Hemerobius fumatus Motschulsky, 1853, p. 20 (Russia).—Hagen, 1866, p. 412.

Head with vertex blackish brown, shining, narrow median blackish streak over coronal sulcus usually not pronounced; face blackish brown with the exception of the clypeus and labrum, which are yellowish; palpi brownish; antennal segments brownish black to black, of approximately 46 segments; legs yellowish to light brownish with mesothoracic and metathoracic coxae brown; thorax blackish brown; abdomen blackish brown.

FOREWING (pl. 1, fig. 2): Average length female 5 mm., male 4.7 mm., average width female 2.1 mm., male 2 mm.; apex rounded, oval; membrane more or less uniformly light brown (sometimes faint indications of light brown streaks, particularly near cubital area toward inner margin); longitudinal veins brown; pterostigma slightly darker than membrane; R2 usually not forked basad to level of junction of Sc and R1; R4+5 usually forked more deeply from margin than R3, distad to or at about level of junction of Sc and R1; MP1+2 usually forking into almost even branches to margin; Cu1 with 3–5 branches to margin; approximately 11–15 costal cross-veins before pterostigma; usually three radial cross-veins; 1st r above and near midpoint of Rs (occasionally near fork of R4+5 from Rs), 2d r usually above R2 near forking of R2 and R3 before fork (occasionally to Rs) and 3d r to R2 or R2 terminal fork, below pterostigma; marginal forking well-developed.

HINDWING (pl. 1, fig. 2): Average length female approximately 4.3 mm., male 4.2 mm., average width female 2 mm., male 1.8 mm.; membrane almost hyaline, tinted with light brown, pterostigma darker brown; R2, R3, and R4+5 with terminal forks usually distad of level of junction of Sc and R1; R2 and R4+5 usually forked more deeply than R3; MA forked basad of above point; Cu1 with about 4–6 branches to margin; usually two radial cross-veins, 1st r slightly

distad of forking of R2 and R3 from Rs; 2d r to R2 or R2 fork under pterostigma near margin; marginal forking well-developed.

Male genitalia (fig. 13, A,B,D): Eighth tergite appearing divided in two with almost invisible median portion; two parts of ninth tergite small, irregularly shaped, usually with a narrow posteroventral projection; tenth tergite with irregular lateroventral margins; ninth sternite large, long, heavily setose, almost rectangular; tenth sternite with short basal plate, less than half as long as claspers; claspers moderately long, thick at base, with rounded curve preceding terminal

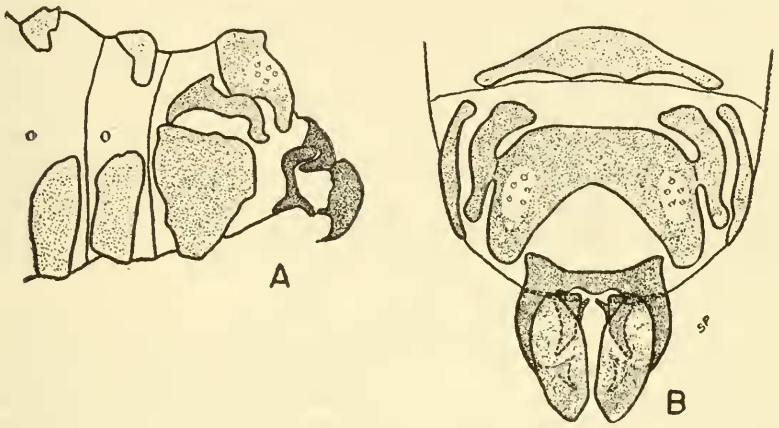

Figure 15.—Terminal abdominal segments of *Sisyra minuta* Esben-Petersen, male, holotype. A, lateral view; B, dorsal view.

portion which tapers almost to a point, two distal toothlike projections at end of each clasper; parameres "leglike," broad anterodorsally, then narrowing, becoming more twisted and diverging into terminal "foot" with "toes" pointing medially toward bases of claspers.

Female genitalia (fig. 13,c): Eighth tergite short dorsally, lengthening above and shortening around spiracle and then gradually lengthening ventrally; ninth tergite with each lateroventral half large, more or less triangle shaped with one posterior articulation ridge, greatest width at proximal border, dorsal border sloping obliquely posteroventrally, ventral margin distinctly rounded; tenth tergite tapering strongly lateroventrally.

Holotype: A female (pinned), labeled *Hemerobius fuscatus* Fabricius; in Universitetets Zoologiske Museum, Copenhagen (Dania D. de Sehestedt).

The holotype, kindly examined by Dr. S. L. Tuxen of the Universitetets Zoologiske Museum, bears a label with only the name *H. fuscatus* on it. Dr. Tuxen wrote: "But that seems always to be the case when the insects were collected by Sehested(t) or Tønder Lund

themselves in Denmark, then they did not give the locality name on the label." Fabricius (1793, p. 84) gave "Habitat in Dania D (om) de Sehestedt" with his description.

The holotype has both metathoracic legs and the apices of all four wings missing; otherwise the specimen is in "good condition" according to Dr. Tuxen. A sketch of the forewing by Dr. Tuxen shows that R2 and R3 both have terminal forks distad to and MA at about the level of the junction of Sc and R1; r-m runs from R4+5 to MA.

Distribution (specimens examined): *United States:* Maine: Augusta; Bar Harbor; Indian Town. Massachusetts: Mount Toby. Michigan: Detroit; Douglas Lake; Livingston County (E. S. George Reserve); Pinckney; Twin Lakes (Houghton County). Minnesota: Cass County; Itasca Park. New York: Milford Center; Saranac Inn; Sport Island (Sacandaga River). Wisconsin: Minong; Palmyra; Spooner (Namakagon River). *Canada:* British Columbia: Kaslo; Lillooet (Seton Lake). Ontario: Biscotasing; Go Home Bay; Honey Harbor; Lake of Bays. Quebec: Perkins Mills; Thunder River. *Alaska:* Chitina; Gulkana River; Matanuska.

S. fuscata is widely distributed and is the only sisyrid known at present to occur in both the Nearctic and Palaearctic regions. These represent the first Nearctic records. Thus far it has been taken in the northern part of the United States only as far west as Minnesota, but from coast to coast in southern Canada. In Europe its range is from Great Britain in the west across to and reaching Russia in the east, from Norway in the north down to Spain and Sardinia in the south. The adults examined were collected from May 30 to August 30 in North America.

The Alaskan specimens and some of the Palaearctic specimens examined were noted to possess somewhat longer and more slender claspers and to be somewhat darker. However, because of variations shown by individual specimens in each region, nominal varieties are not here recognized. Navás (1935, p. 44) recognized var. *nigripennis* Wesmael for the darker, more blackish forms of Europe.

The synonymy of *fuscata* is complicated. Degeer (1771, p. 713, pl. 22, figs. 8–11) described "*Hemerobe velu noir*," which Retzius (1783, p. 59) later placed under the name *Hemerobius niger*. Olivier (1792, p. 64) also gave a description for *Hemerobius niger* based on Degeer's species. Burmeister (1839, p. 976) placed Degeer's species in synonymy with *S. fuscata*. Walker (1853, p. 296) considered *niger* a synonym of *fuscata*. Since *Hemerobius niger* ("*Hemerobe velu noir*" of Degeer) was described in 1783, before Fabricius' description of *fuscatus* in 1793, the former would seem to be the valid name on the basis of priority. However, upon attempting to locate Degeer's

type of "*Hemerobe velu noir*," Dr. René Malaise of the Riksmuseum, Stockholm, kindly replied that "out of seven species labelled in the DeGeer collection under the genus *Hemerobe* the *velu noir* is the only one lacking an insect. The type must have been missing already when the collection was rearranged more than (one) hundred years ago (in 1844), as there is no pin-hole under the name." In this paper, *Hemerobius niger* is not recognized because of its doubtful status, but the well known name of *Sisyra fuscata* is recognized instead.

Concerning the other synonyms (*confinis*, *fumatus*, *morio*, *nigripennis*, and *nitidulus*) (Killington, 1936, p. 230; Navás, 1935, p. 43) it was not possible to procure the types and compare them, since they are variously located. The descriptions, however, appear to agree with *fuscata*. It is not definitely known whether Westwood's larva of *Branchiotoma spongillae* was compared with the other British species of *Sisyra* (*dalii*, *fuscata*, *terminalis*) and found to be *fuscata*.

S. fuscata, the darkest species of *Sisyra*, is readily distinguished from *vicaria* and *apicalis* by the characters pointed out in the key.

Sisyra apicalis Banks

FIGURE 16; PLATE 1, FIGURE 1

Sisyra apicalis Banks, 1908, p. 261 (Havana, Cuba).—Navás, 1935, p. 66.

Head with vertex from yellowish to dark brown, usually a narrow black ring around antennal sockets, coronal sulcus from posterior margin to midvertex sometimes indistinct; face light brown to yellowish; palpi yellowish to brownish; basal antennal segments light brown to blackish, the following 17 segments (approximately) blackish brown, the next 15 (approximately) yellow and the 3–5 terminal ones fuscous (about 36–38 segments altogether); legs yellow, with some brown occasionally, mesothoracic and metathoracic coxae brown, prothoracic coxae lighter; thorax dark brown; abdomen dark brown or blackish.

FOREWING (pl. 1, fig. 1): Average length female 4.4 mm., male 4.3 mm., average width female 1.7 mm., male 1.6 mm.; membrane with distinct brown intervenational streaks margined with pale adjacent to longitudinal veins; sectoral branches with terminal forks near margin usually far distad of level of junction of Sc and R1; MA with terminal fork which may be basad to above point; MP1+2 with even fork to margin; Cu1 with 4–6 parallel branches to margin; approximately 10–12 (11 most common) costal cross-veins before pterostigma; usually two radial cross-veins (rarely only one), or with a third cross-vein close to 2d r (irregular), 1st r usually basal to midpoint of free stem of Rs, 2d r near point of forking of R2 and R3; 1st r-m from R4+5 to MA (near where it separates from Rs), Rs, or to fork.

HINDWING (pl. 1, fig. 1): Average length female 3.8 mm., male 3.75 mm., average width female about 1.5 mm., male 1.4 mm.; membrane almost hyaline, faintly tinted with light brown at margin; pterostigma slightly darker than membrane; R2, R3, and R4+5 usually with terminal forks not basad of level of junction of Sc and R1; MA with deeper fork; MP1+2 with an irregular marginal fork usually; Cu1 with 5–7 branches to margin; usually one radial crossvein, with position varying from point of forking of R2 and R3, along R2, or Rs just basad of fork.

MALE GENITALIA (fig. 16,A,B): Eighth tergite appearing almost divided in two; two parts of ninth tergite small, more or less rounded; ninth sternite moderately large, heavily setose; tenth sternite with basal plate short, about one-eighth as long as claspers, lateroventral margins tapering; claspers long, smoothly and gradually curved, of almost equal width from about two-thirds of length to end; both of parameres in two pieces, the basal piece much longer.

FEMALE GENITALIA (fig. 16, C); Eighth tergite short dorsally, lengthening to spiracle, then shortening ventrally, anterior and posterior margins irregular; ninth tergite with each lateroventral half ovate, longitudinally elongate, approximately three-fourths as broad as long, with one posterior sclerotized articulation ridge, dorsal border almost convex; ninth sternite with halves blunt at apex with thin dark brown line outlining dorsal margin of apex in form of a recurved hook.

HOLOTYPE: A female (pinned) from Havana, Cuba, collection of N. Banks; MCZ.

The holotype is complete except for a broken left antenna (of 11 segments; 36 in right antenna). The vertex is dark brown, and the basal two antennal segments are brown; in the forewing 1st r-m runs to R4+5 and Cu1 has five branches running to the margin. It was probably collected by C. F. Baker, according to Banks (1908, p. 261), although the label on the type did not state so.

ALLOTYPE: A male (pinned) from Soledad, near Cienfuegos, Cuba, "6–20–viii (N. Banks)"; MCZ; by present designation.

The allotype has both antennae broken (approximately four segments remaining in the left and five in the right) and the tip of the abdomen slightly mashed.

DISTRIBUTION (specimens examined): Cuba: Cayamas; Soledad (near Cienfuegos); Havana. Florida: Fruitville; Hardee County; Marion County; Palm Beach; Paradise Key; Winter Park. Georgia: near Savannah. Panamá: Canal Zone; Coclé; Pedregal; Tapagra; Tocumén.

The adults examined were collected from January through December 16. A male was taken at Miami on aircraft direct from Tegucigalpa to Miami on Mar. 4, 1954, indicating that this species is

probably found in Miami also. There is a possibility that *apicalis* may occur in other southern states and in other sections of Central America and the West Indies. It is uncommon in the United States.

This species belongs to that Neotropical group of *Sisyra*—which contains the smaller species (*apicalis*, *nocturna*, *panama*, but not *minuta*)—characterized by having forewings which show distinct intervenational streaking, two radial cross-veins, and the basal segment of the antenna more smoothly curved on the inner margin and more elongate, and the venation slightly less extensive. The *apicalis*

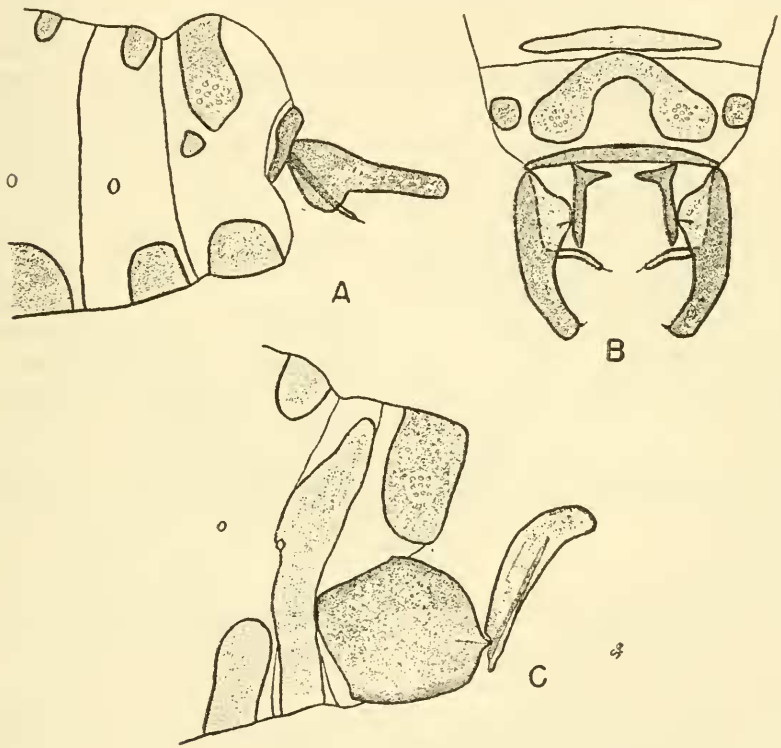

FIGURE 16.—Terminal abdominal segments of *Sisyra apicalis* Banks. A, male, lateral view; B, same, dorsal view; C, female, lateral view.

group might perhaps justifiably be placed in another genus; however, since the longitudinal veins, palpi, and other morphological features are otherwise so similar to *vicaria* and *fuscata*, they are left in *Sisyra*. *S. apicalis* can be separated from the other Neotropical species by the striking antennal coloration, the slightly larger size, and the genitalia.

Specimens of *apicalis* from Panamá are smaller (average wing length 3.7 mm., width 1.3 mm.) than the Florida specimens; also, the male claspers are slightly longer than in those from Florida.

Sisyra panama, new species

FIGURE 17; PLATE 1, FIGURE 4

FEMALE (holotype): Head with vertex yellowish brown with some dark brown behind antennae, narrow median blackish streak over coronal sulcus from posterior margin to midvertex pronounced; face yellow; palpi yellowish; basal antennal segment yellow dorsomedially and ventromedially, brown laterally, rest of antennae yellowish to light brown (of at least 36 segments); legs yellow to yellowish brown, mesothoracic and metathoracic coxae brown; thorax brown; abdomen brown.

FOREWING (pl. 1, fig. 4): Length 4 mm. width 1.4 mm.; apex rounded, oval; membrane with distinct intervenational brown streaks margined with pale adjacent to longitudinal veins; pterostigma brown, with faint elongate pale spot over central portion; Rs forking basad of longitudinal center of wing, first giving off R4+5, then R2+3, separating from Rs a short distance beyond, at about level of 2d r; sectoral branches forking near margin, far distad of level of junction of Sc and R1; MA, MP1+2, and MP3+4 with terminal forks at about or basad of junction of Sc and R1; MP1+2 with uneven fork to margin, the first branch far removed from the second; Cu1 with four branches to margin; 12 costal cross-veins before pterostigma in right wing, 11 in left; two radial cross-veins, 1st r slightly basad of midpoint of free stem of Rs, 2d r at about longitudinal midpoint of wing at forking of R2 and R3; one sectoral cross-vein from R4+5 to R3 slightly distad of separation of R2 and R3; one radiomedial cross-vein, 1st r-m from R4+5 to MA; marginal forking scantily developed.

HINDWING (pl. 1, fig. 4): Length 3.7 mm., width 1.3 mm.; membrane almost hyaline, tinted with brownish shading along apical margin, with light brown intervenational streaking along outer and inner margin to Cu1 branches; pterostigma brown; Rs giving off R4+5 slightly distad of center of wing, the R2 and R3 fork typically separating from Rs a short distance beyond; MA, MP1+2, and MP3+4 with usual deeper marginal forks; Cu1 with five branches to margin; one radial cross-vein, 1st r to R2; marginal forking scantily developed.

FEMALE GENITALIA (fig. 17,c): Eighth tergite shorter dorsally, lengthening around spiracular region and ventrally, anterior margin slightly convex; ninth tergite with each lateroventral half moderately elongate, more or less "pear shaped," broader at anterior margin, one posterior articulation ridge, basal and ventral borders rounded; tenth tergite shorter dorsally, with approximately seven trichobothria.

HOLOTYPE: A female (pinned) from Panamá, Caño Saddle, Gatún Lake, May 8, 1923 (R. C. Shannon); USNM 62258.

The holotype is lacking the left hindwing and tips of the antennae. Not all of the abdomen was dissected and the halves of the eighth tergite appear to have been accidentally broken posteroventrally. The right wings are on a slide.

Not to be confused with Canoa Saddles, Caño Saddle is sometimes given as Caño Saddles, and is located along the southwestern shore of Gatún Lake (about 7 miles southwest of Escobal and 13 miles southwest of Barro Colorado Island).

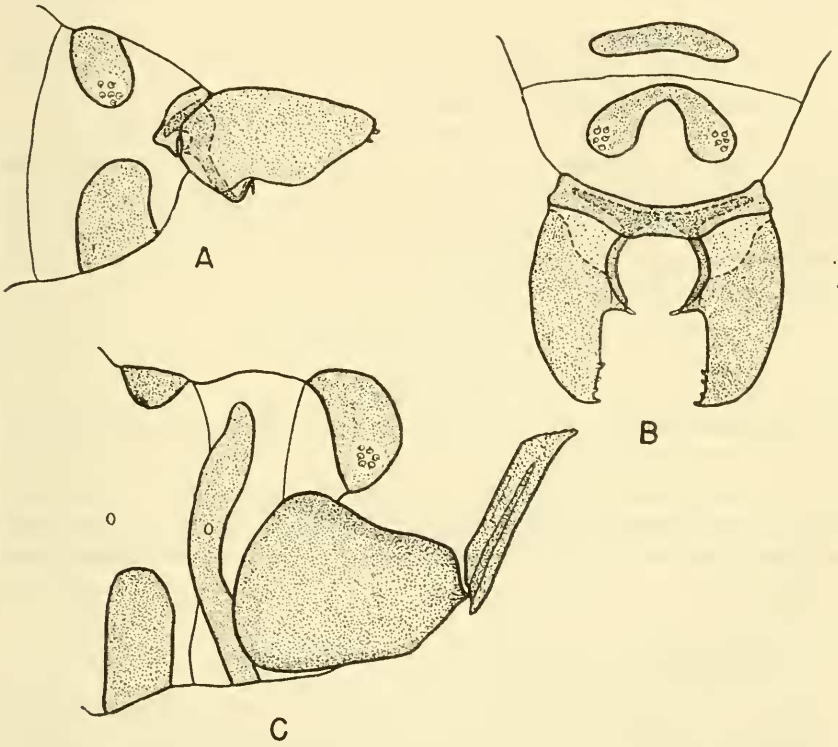

FIGURE 17.—Terminal abdominal segments of *Sisyra panama*, new species: A, male, allotype, lateral view; B, same, dorsal view; C, female, holotype, lateral view.

MALE (allotype): Similar to holotype. Forewing with r-m crossvein between Rs and MA.

MALE GENITALIA (fig. 17,A,B): Tenth sternite with basal plate considerably shorter than claspers; claspers stout throughout length, with long setae and distal inner teeth; parameres with basal portions broadly triangular, distal portions narrow, caliperlike.

ALLOTYPE: A male from Farallón, Coclé Province, Panamá, Nov. 8, 1952, in light trap (F. S. Blanton); USNM.

The allotype is badly damaged. The antennae beyond the basal segments and three legs are missing. The right wings are on a slide, and the abdomen, left wings, head and thorax are in alcohol.

Sisyra panama is readily separated from *apicalis*, also found in Panamá, by the stouter male claspers, more pear-shaped lateroventral halves of the ninth tergite of the female, and brown antennae. The forewing differs from *apicalis* and *nocturna* in the more basal forking of R2+3 and pale area in the pterostigma. It is not known whether the sectoral cross-vein found in both the holotype and allotype of *panama* is constant. *Sisyra panama* also differs from *apicalis* in the more extensive dark brown apical shading along the margin of the hindwing.

This is the third species of *Sisyra* to be recorded from Central America, the first, *nocturna*, having been taken in British Honduras, and the second, *apicalis*, in Panamá.

There is no difficulty in distinguishing *panama* from *minuta* (although similar in respect to the presence of the two radial cross-veins in the forewing and one in the hindwing) because of the dip where Sc approaches R1 apically, the absence of the brown streaking between the longitudinal veins, and the small size (3.2 mm. in *minuta;* 3.8–4 mm. for *panama*) in *minuta*.

Sisyra nocturna Navás

PLATE 1, FIGURE 5

Sisyra nocturna Navás, 1932, p. 115, fig. 76; 1932a, p. 155 (British Honduras); 1935, pp. 67–68, fig. 37.

Since the holotype (the only specimen of the species and kindly lent by Dr. Francisco Español Coll of Barcelona, Spain) consists only of a torn left forewing and a right hindwing, the original description is translated:

Body yellow.

Head fuscous above; eyes fuscous; palpi yellow.

Thorax with a broad longitudinal fuscous or fuscouslike band.

Apex of wings elliptical, strongly reticulated, rusty yellow hairs and fringe of the same color; stigma lightly rust-colored, divided by cross-veins.

Membrane of anterior wing (fig. 76) beyond the subcosta lightly stained with rust-color, pale adjacent to veins and branches, with pale rust-colored streaks between the veins and branches; costal area with 8–10 cross-veins, distal ones farther apart; radial sector arising near subcostal cross-vein, 3 long branches; procubitus divided beyond the place of the first branch of the sector, cubitus divided near base of wing; 2 radial cross-veins, one cross-vein between the first branch of the sector and the sector, 2 procubital, one cubital, with cubital cell 2a open.

Posterior wing paler, membrane only slightly stained with rust-color before the margins; radial sector with 3 branches, apex forked; procubitus forked at place of first branch; one intermediate cross-vein between the first branch and procubitus, one procubital, located far beyond intermediary.

Long. al. ant. 4′4 mm.

— — post. 3′6 mm.

Navás (1935, p. 67, fig. 37) translated the original description into Spanish with certain alterations and used the same figure. In the first line "with hairs of the same color" was added; second line, "head black above" instead of "fuscous." In the paragraph on the forewing, changes included: "beyond the radius" instead of "beyond the subcosta"; "between the veins," omitting "and branches"; omitted "3 long branches" and added "a cross-vein between the first and second branches"; "between the first branch of the sector and forking of the procubitus" instead of "between the first branch of the sector and the sector." In the paragraph on the hindwing, Navás omitted "radial sector with 3 branches, apex forked."

Examination of the type showed that the wings agreed essentially with the original description. The membrane of the forewing appears to be streaked from the subcosta to the inner margin as in the original description, not the radius as in the later description, and the costal area showed about 12 costal crossveins before the pterostigma. MA, MP1+2, MP3+4 have terminal forks basal to the level of junction of Sc and R1; MP1+2 has an even fork to the margin; there are five branches of Cu to the margin; 1st r is basad to the midpoint of the free stem of Rs, 2d r is near the longitudinal midpoint of wing at forking of R2 and R3; r–m is between Rs and MA; and 3d m–cu reaches Cu1 proximal to the fourth branch of Cu1. In the hindwing there is one radial cross-vein and seven branches of Cu1 to the margin.

Since neither of the wings is whole, it is not known how accurate the measurements of Navás are. The widths, however, appear to be about 1.8 mm. for the forewing and 1.7 mm. for the hindwing.

Neither collecting data nor type designation accompanied either description. In a supplement to the original in the same volume but in fascicle 4 of Brotéria, Navás (1932a, p. 155) included the following:

A la descripción de esta especie (p. 115) añadase lo seguiente: Patria. Honduras: Calas, 16–x–1893 atraido por la luz. Dr. Dampf leg.

Un ejemplar en muy mal estado que por esta razón habia quedado en mi collección sin nombre, pero que ahora ha sido preciso describir de alguna manera.

Upon examination of the labels attached to the type specimen it was noticed that what apparently looked like "Calas" to Navás, appeared to be "Cacao," and that what Navás had interpreted as "1893," looked like "23" on the label. Investigation into the literature revealed that Alfonso Dampf had made collections at Río Cacao in British Honduras during the period of Oct. 15, 16, 18, 1925 (see E. Martini, Departmento de Salubridad Publ. Bol. Tecn., ser. A., No. 1, 65 pp., 11 figs., 1935). Dr. C. P. Alexander stated in a letter dated May 1952 that, after checking his earlier correspondence with Dampf, to the best of his knowledge Dampf was in British Honduras

only in 1925 or very late in 1924. Furthermore, in the supplement, Navás (1932, p. 155) stated that the specimen was caught "por la luz" when the label actually read "a la luz." Upon comparing the label with certain Dampf labels on mosquitoes in the U. S. National Museum, it appears possible that the locality label on the type could have been written by Navás himself, and not by Dampf. With the above evidence taken into consideration, the designation of the type locality is interpreted as follows:

HOLOTYPE: A specimen from Río Cacao, British Honduras, Oct. 16, 1925, at light (Dr. Alfonso Dampf); in the Instituto Municipal de Ciencias Naturales Museos, Barcelona, Spain.

Because the type specimen is reduced to the wings illustrated, it is impossible to check other features. Comparison of the descriptions with specimens of *apicalis* shows that the lengths of the forewings and hindwings, and color of the vertex are similar. The venation is also strikingly similar. Whether the broad longitudinal fuscous stripe over the thorax of *nocturna*, mentioned by Navás, is a significant character is not yet known; it has not been observed in the other species of *Sisyra*. It is possible that further collecting may show *nocturna* to be a synonym of *apicalis*.

Sisyra minuta Esben-Petersen

FIGURE 15; PLATE 1, FIGURE 6

Sisyra minuta Esben-Petersen, 1935, p. 152 (Taderinha, Brazil).

MALE (holotype): Head with vertex yellowish brown, narrow median blackish streak over coronal sulcus from posterior margin to midvertex distinct, narrow blackish ring around basal antennal segments; frons yellowish brown, clypeus and labrum yellow; palpi brownish; basal two antennal segments brown, rest yellow, of at least 31 segments; legs yellow; pronotum brown anteriorly, yellowish posteriorly, brown at anterior margin, with central blackish longitudinal streak, mesonotum and metanotum yellowish brown, mesothoracic and metathoracic pleura brownish yellow; abdomen brownish yellow.

FOREWING (pl. 1, fig. 6): Length 3.2 mm., width 1.3 mm.; membrane uniformly light brown with darker brown shading along apical margin; veins slightly darker than membrane with small black setal pits; R1 bent at an angle at junction with Sc, then dipping strongly toward R2; Sc appearing to run free to margin and joined by a cross-vein; sectoral branches and MA forking near margin far distad of level of junction of Sc and R1; MP1+2 and MP3+4 forked more deeply, usually basad of above point, MP1+2 with even fork to margin; Cu1 with two branches to margin; approxi-

mately nine costal cross-veins before pterostigma; two radial cross-veins, 1st r slightly distal to midpoint of free stem of Rs, 2d r slightly distal to longitudinal midpoint of wing; r-m from R4+5 to MA; marginal forking less extensive.

Hindwing (pl. 1, fig. 6): Length approximately 2.7 mm.; width 1.1 mm.; membrane almost hyaline, slightly tinted brownish, pterostigma slightly darker; sectoral branches with short terminal forks; MA, MP1+2 and MP3+4 with deeper marginal forks basad of level of point of coalescence of Sc and R1; Cu1 with three widely spaced branches to margin; marginal forking scanty.

Male genitalia (fig. 15): Eighth tergite entire, broad, short, tapering lateroventrally; two parts of ninth tergite long, narrow, irregularly shaped, appearing almost united with tenth tergite; ninth sternite large, heavily setose, much longer laterodorsally than medioventrally; tenth sternite with basal plate about one-half length of claspers, anterior margin concave, lateral margins with deep incisions; claspers of moderate length, broad, shaped like a parrot's beak from lateral view, apices acute and directed medioventrally; parameres almost completely concealed by claspers, dorsal portion broad, central piece narrow and ventral portion tapering anteriorly and posteriorly.

Holotype: A male (pinned) from "Unt. Amaz. Taperinha b. Santarem, 1–10.viii.27, Zerny"; in Naturhistorisches Museum, Vienna, Austria.

Taderinha was misspelled to "Taperinha" on the type label. The collecting data for the type is thus interpreted: Brazil, Lower Amazons, Taderinha, near (approximately 20–25 miles east of) Santarem, August 1–10, 1927, collected by Dr. H. Zerny.

The holotype has the left antenna beyond the basal segment and the tip of the right antenna missing (31 segments remaining) and the right and left hindwings are torn below the apex. It was lent for study through the courtesy of Dr. Max Beier of the Naturhistorisches Museum.

The female is unknown.

This is the only South American species of *Sisyra* recognized thus far, and it is the smallest species. It is a very distinctive species, standing apart from others in a number of characters: its smallness, the angular bend and dip of R1 where it meets Sc, the free course of Sc to the margin, the two radial cross-veins coupled with the almost uniform membrane tinting and lack of intervenational streaking, the unusual male genitalia, and the entirety of the eighth tergite. Some of these features might suggest another genus. However, the palpi, pronotum, and venation in general are similar to other species of *Sisyra*. The angular bend of R1 under the pterostigma

appears to be so pronounced only in this species; since this is at present a unique specimen, the constancy of this character is unknown.

Genus *Climacia* McLachlan

Climacia McLachlan, 1869, p. 21.—Banks, 1905, p. 26.—Navás, 1935 p. 31.—Carpenter, 1940, p. 255.

Variegated spongilla-flies.

Genotype: *Micromus areolaris* Hagen, by original designation of McLachlan (1869, p. 21).

Head (figs. 8,I; 9,B,D,G,H): Antennae sometimes with as many as 71 segments, two whorls of setae on all but basal segment, on which the setae are irregularly arranged; face longer than in *Sisyra*; clypeus sometimes giving appearance of being lobed; labrum usually bilobed, about 1⅓ times as broad as long, setose (fig. 9,D); postoccipital margin of foramen convex medially, concave laterally on each side; maxillary palpi with basal two segments short, fourth slightly longer, third longer than first, second or fourth, fifth longest, narrow, more or less cylindrical, broadest at point about third of length, curved slightly laterally and acute at apex, galea terminally somewhat lobed, lacinia broader than that of *Sisyra*, stipes narrower and straighter than that of *Sisyra* (fig. 7,G); labium with postmentum and prementum distinctly separated by a membrane, and anterior and posterior plates of prementum also separated by a distinct membrane, anterior margin of posterior plate with median lobe, differing from *Sisyra* (fig. 7,H) labial palpi with third or terminal segment only slightly enlarged, more cylindrical, apex acute, similar to but smaller than terminal segment of maxillary palpi, second segment slightly longer than first; mandibles usually with a greater number of and longer bristles along both inner and apical surfaces than in *Sisyra* (fig. 9,G,H).

Thorax (fig. 8,E,J,K): Pronotum larger, smoother than that of *Sisyra*, and laterally more extended to overlap the cervicales and dorsal portions of pleural sclerites; laterocervicales larger and more prominent than in *Sisyra*, indentation (*x*, fig. 8,K) of posterior margin of metepimeron deeper than in *Sisyra*, median projection of basisternite triangular; mesonotum and metanotum with scutellum narrower anteriorly than in *Sisyra*, apical shield-shaped depression with posterolateral margins shorter than in *Sisyra*. Legs with tarsi having the first segment the longest, more than one-third the length of tarsus, fourth segment shortest. (Prothorax and neck illustrated by Crampton, 1926, pl. 14, fig. 64.)

Forewing (fig. 11): Costal area with approximately 11–14 costal cross-veins before the pterostigma; subcostal area moderately broad, with one basal subcostal cross-vein below about the third or fourth costal cross-veins; Sc appearing coalesced with R1 at apex of wing

below the pterostigma; Rs+MA separating off from R1 near base, Rs separating from MA slightly basad of 1st r; free stem of Rs with one main fork into R2+3 and R4+5 beyond longitudinal center of wing; MA dividing into two branches usually under pterostigma, but sometimes near center of wing; MP forking into MP1+2 and MP3+4 near level of point of separation of Rs from MA; MP1+2 and MP3+4 with terminal forks under pterostigma, usually at about level of point of coalescence of Sc and R1; Cu1 separating from Cu2 near base of wing; 1st and 3d A usually simple; 2d A usually with marginal fork; 3d A running into and coalescing with 2d A before margin; usually three (rarely two) radial cross-veins between R1 and Rs; two radiomedial cross-veins between Rs and R4+5 and MA; three medial cross-veins between MA and MP1+2 and one medial cross-vein between MP1+2 and MP3+4; three mediocubital cross-veins between MP and Cu1; one cubital cross-vein between Cu1 and Cu2; one basal cubito-anal cross-vein between Cu2 and 1st A; one anal cross-vein between 1st and 2d A; two series of gradate cross-veins, three inner gradates (2d r, 1st r-m, 2d m between MA and MP1+2), and five to eight outer gradates (3d r, 1st s, 2d s when present, 2d r-m, 3d m between MA and MP1+2, m between forking of MA when present, m between MP1+2 and MP3+4, 3d m-cu).

Hindwing (fig.11): Costal area with approximately 7–11 costal cross-veins basad of pterostigma; subcostal area broader than costal area, with one indistinct basal subcostal cross-vein; Sc appearing to be coalesced with R1 at apex; Rs, after branching off from R1 near base, proceeding for a longer distance than in *Sisyra*, then coalescing with MA and finally separating from MA at about center of wing, then proceeding anteriorly back toward R1; forking into one main fork of R2+3 and R4+5, usually at a point slightly basad of point of coalescence of Sc and R1 or under pterostigma; MA separating off from MP farther from costal margin of wing than in *Sisyra* into a free sinuate section, which curves toward and coalesces with Rs for a short distance, then separates and forks at margin; MP forking into MP1+2 and MP3+4 near center of wing at about point of separation of Rs from MA; MP1+2 usually with terminal fork at about level of point of coalescence of Sc and R1; MP3+4 frequently without terminal fork; Cu1 separating from Cu2 near base of wing, with almost parallel marginal branches; 1st A usually simple; 2d A usually with marginal fork; usually two radial cross-veins, the first basad of point of coalescence of Sc and R1, and the second usually below the pterostigma; one sectoral cross-vein between R2+3 and R4+5; one distal radiomedial cross-vein; three medial cross-veins, two between MA and MP1+2, one between MP1+2 and MP3+4; one mediocubital cross-vein to branches of Cu1; one cubito-anal cross-vein basally between Cu2 and 1st A; one anal cross-vein between

1st and 2d A; inner gradates of 1st r and 1st r-m, usually six outer gradates of 2d r, s, r-m, 2d m between MA and MP1+2, m between MP1+2 and MP3+4, m-cu; thyridia usually apparent in centers of radiomedial and medial cross-veins, and sometimes on sectoral cross-veins.

Male genitalia (fig. 18,A–D): Eighth tergite longer dorsally, not as broad as ninth; ninth tergite divided mediodorsally, of diverse form; tenth tergite broader than long, divided mediodorsally into two lateral plates; eighth sternite about as long as or slightly shorter and narrower than seventh sternite, usually with an anterior group of very long setae projecting posteroventrally and with their bases hidden under posterior portion of seventh sternite; ninth sternite entire, ventral to ninth and tenth tergites, frequently with a pair of posteriorly projecting processes on inner surface, more or less embedded in a hyaline membrane; tenth sternite posterior and posteroventral to tenth tergite, in the form of narrow plates, usually broadening ventrally and internally, and covered with toothlike projections bearing long setae; parameres arising within the posterior part of the eighth, and the ninth and tenth tergites, partially fused, complex, usually bearing a median lobe or flap, which diverges abruptly anterodorsally from the posterior portion of plate, a pair of curved hooklike processes posteriorly.

Female genitalia (fig. 18,E): Eighth tergite usually divided middorsally and appearing fused midventrally; ninth tergite typically divided into two large plates, each moved lateroventrally to the tenth tergite, heavily sclerotized, usually longer than broad and with a posterior ridge for articulation with ninth sternite; tenth tergite entire, small, broader than long, thickly covered with long setae, frequently shorter dorsomedially; ninth sternite divided into two elongate movable upturned parts projecting and tapering more or less dorsally, usually bent posteriorly just before apex, each half articulated ventrally at posterior articulation ridge of ninth tergite, with small narrow ventral projection; tenth sternite not accounted for.

Basal abdominal segments. Second to fifth tergites usually smaller and shorter than sixth and seventh, often rounded (*chapini, nota*); fourth to seventh tergites sometimes oval (*carpenteri, chilena, nota*); second sternite large, usually with V-shaped streak, with each half beginning along lateral margins, sometimes just posterior to center (*basalis, carpenteri, chapini*) or in posterior corners (*nota*) and curving anteriorly to meet in point just before anterior margin; third sternite with streak with each half beginning in posterior corners and meeting other half in center of sternite so almost parallel with anterior margin; fourth sternite with streak usually almost parallel

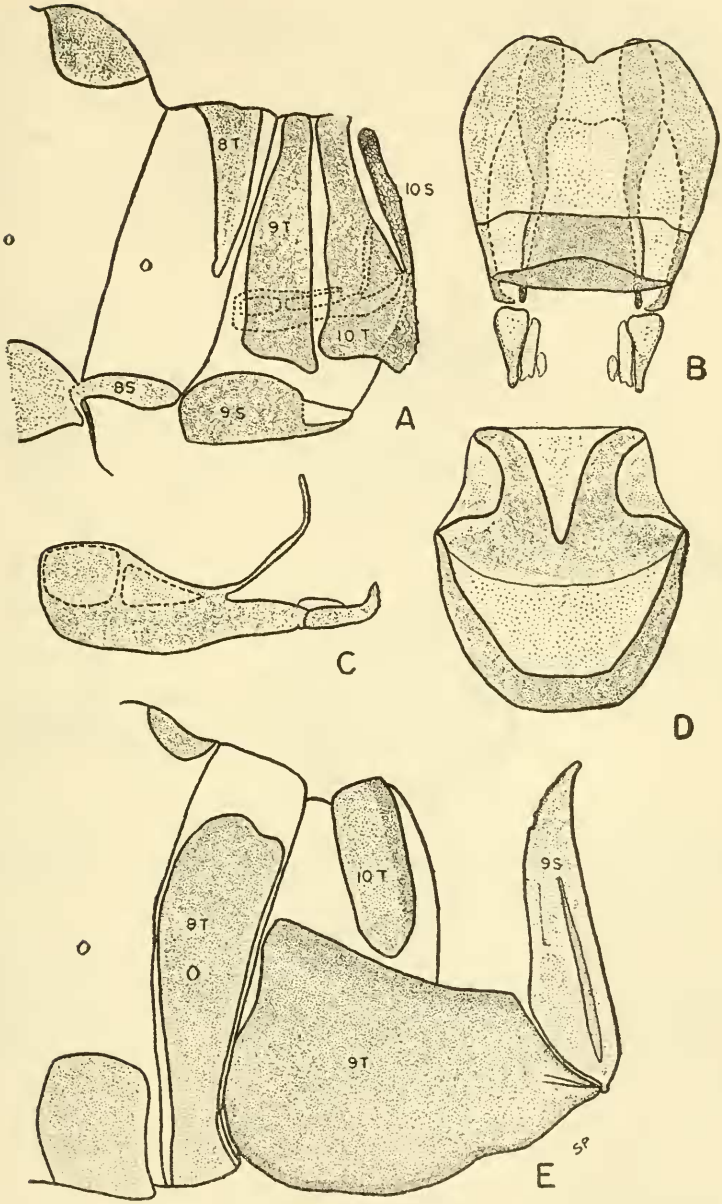

FIGURE 18.—*Climacia areolaris* (Hagen). A, terminal abdominal segments of male, lateral view; B, parameres, dorsal view; C, same, lateral view; D, ninth sternite of male, posteroventral view; E, terminal abdominal segments of female, lateral view. Abbreviations as in figure 14.

with anterior border; sometimes fifth (*nota, striata*) and sixth (*nota*) also with streaks. Second sternite of *arcolaris* emarginate laterodorsally and narrower medioventrally.

The genus *Climacia* is at present known only from the Western Hemisphere, and 11 species, 7 of them described herein, have been taken as follows: North America: *areolaris* (Hagen) (United States and Canada), *californica* Chandler (California, Oregon), *chapini*, new species (New Mexico, Texas). Central America: *tenebra*, new

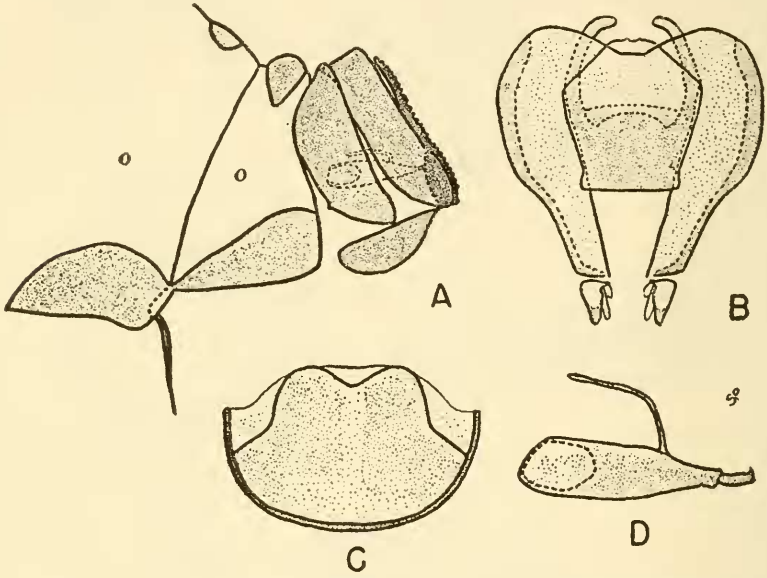

FIGURE 19.—Terminal abdominal segments of *Climacia striata*, new species, male, holotype. A, lateral view; B, parameres, dorsal view; C, ninth sternite, posteroventral view; D, parameres, lateral view.

species (Honduras), *striata*, new species (Panamá). South America: *basalis* Banks (British Guiana), *bimaculata* Banks (British Guiana, Surinam), *carpenteri*, new species (Paraguay), *chilena*, new species (Chile), *nota*, new species (Venezuela), *townesi*, new species (Brazil, Perú).

Key to the species of Climacia in the Western Hemisphere

1. A conspicuous radiomedial streak [7] in forewing (pl. 2). 2
   No conspicuous radiomedial streak in forewing 10
2. Radiomedial streak in forewing closely associated with other less pronounced dark intervenational streaking immediately adjacent to streak (pl. 2, figs. 1, 3–5) 3
   Radiomedial streak in forewing distinct from other dark intervenational streaking (pl. 2, figs. 2, 6–9). 6

[7] The basal brownish black pigmentation found in the vicinity of R1, Rs, MA, or Rs+MA (sometimes extended anteriorly and posteriorly) in some species.

3. Forewing with 3d r close to 2d r and basad of point of coalescence of Sc and R1, with cell 2d R1 not more than two or three times as long as broad (pl. 2, figs. 3, 4) 4

   Forewing with 3d r usually under pterostigma or at level of point of coalescence of Sc and R1, not close to 2d r, cell 2d R1 more than three times as long as broad (pl. 2, figs. 1, 5) 5

4. Pale portion of pterostigma narrow, covering one or two costal cross-veins; wing membrane extensively brownish; face yellow, vertex yellow with small blackish spot immediately behind antennae; each half of ninth tergite of female a little over one-half as wide as long (fig. 20,A; pl. 2, fig. 4).

   tenebra, new species (p. 501)

   Pale portion of pterostigma broader; wing membrane less brownish; face with longitudinal brownish streak, vertex brown; each half of ninth tergite of female two-thirds as wide as long (fig. 21; pl. 2, fig. 3).

   californica Chandler (p. 491)

5. Forewing with pale area of pterostigma long (covering about seven costal cross-veins); 3d m between MA and MP1+2 long, usually obliquely directed basad; antennae brownish black; tenth tergite of male with ventral border widened, dorsal border narrow (fig. 18; pl. 2, fig. 1).

   areolaris (Hagen) (p. 486)

   Forewing with pale area of pterostigma short (covering about four costal cross-veins); 3d m between MA and MP1+2 shorter, usually directed distad; antennae with blackish band between two yellow portions; tenth tergite of male of almost uniform length dorsally and ventrally (fig. 19, pl. 2, fig. 5) . . . . . **striata,** new species (p. 499)

6. Forewing with basal radiomedial streak longitudinally elongate (pl. 2, figs. 1–5, 8,9) 7

   Forewing with basal radiomedial streak transversely elongate (pl. 2, figs. 6, 7). 9

7. Radiomedial streak short, straight, barely reaching 1st r; no pronounced spotting or streaking other than setal spots on longitudinal veins (pl. 2, fig. 9) . . . . . **nota,** new species (p. 503)

   Radiomedial streak longer, more or less crescent shaped, reaching beyond 1st r; streaking or spotting other than setal spots may be present . . . 8

8. Radiomedial streak long, narrow, usually beginning from where Rs+MA and MP approach each other basally; antepterostigmal spot usually pronounced; subcostal cross-vein dark; longitudinal veins without pronounced setal spots; each half of ninth tergite of female moderately elongate and broad (fig. 22,E; pl. 2, fig. 2) . . . . . **chapini,** new species (p. 495)

   Radiomedial streak shorter, usually beginning from where Rs+MA separate from R1 basally; antepterostigmal spot either absent or faint; subcostal cross-vein pale; longitudinal veins with pronounced setal spots; each half of ninth tergite of female more elongate, narrower (fig. 23,A; pl. 2, fig. 8).

   basalis Banks (p. 504)

9. Forewing with basal radiomedial streak broad anteriorly, narrow posteriorly, directed basad; remainder of forewing clear except for antepterostigmal spot (also broad anteriorly, narrow posteriorly); setal spots not pronounced; female with each half of ninth tergite considerably elongate and narrow (fig. 23,B; pl. 2, fig. 6) . . . . . **bimaculata** Banks (p. 507)

   Forewing with basal radiomedial streak directed distad; indistinct antepterostigmal spot; setal spotting pronounced; light brown intervenational streaking along inner and outer margins; female with each half of ninth tergite moderately elongate (fig. 24,B; pl. 2. fig. 7).

   carpenteri, new species (p. 511)

10. Heavy brownish black anal streaking in forewing; 2d m usually directly below 1st r-m; setal spotting on longitudinal veins inconspicuous (pl. 3, fig. 1). **townesi**, new species (p. 509)

No heavy anal streaking in forewing; 2d m usually basad of 1st r-m; setal spotting conspicuous (pl. 3, fig. 2) . . . . . **chilena**, new species (p. 515)

Climacia areolaris (Hagen)

FIGURE 18; PLATE 2, FIGURE 1

Micromus areolaris Hagen, 1861, p. 199 (Florida).

Climacia areolaris McLachlan, 1869, p. 21, fig.—Banks, 1905, p. 25.—Navás, 1935, p. 32, figs. 15–18.—Carpenter, 1940, p. 255, text-figs. 57, 58; pl. 3, fig. 24.

Climacia dictyona Needham, 1901, p. 558, text-figs. 34–36; pl. 12, figs. 1–5 (Saranac Inn, N. Y.).—Banks, 1905, p. 26.

Sisyra lampra Navás, 1914, p. 60 (Lakehurst, N. J.); 1935, pp. 33, 34.

Head with vertex yellow, occasionally with some yellowish brown, sometimes a longitudinal, dark brown streak immediately behind and adjacent to pronotal margin (not always visible on pinned specimens); face yellow, sometimes light brownish; palpi yellow; antennae blackish brown, often becoming slightly lighter at the apices (approximately 57–62 segments); legs yellow, with mesothoracic and metathoracic coxae brown; pronotum yellowish to medium brown dorsally, sometimes with central blackish brown streaking, mesothoracic and metathoracic pleura darker brown; abdomen brownish.

FOREWING (pl. 2, fig. 1): Average length of female 5.2 mm., male 4.6 mm., average width of female 1.8 mm., male 1.48 mm.; membrane yellowish with two prominent and two less conspicuous blackish brown spots and three prominent yellowish to hyaline areas; the first large dark brown patch, the basal radiomedial streak, longitudinally elongate and usually beginning in the subcostal space about where Sc and R almost meet, continuing along R+MA to R or almost to Rs posteriorly, extending laterally to vicinity of 1st r, the second an oblique antepterostigmal spot directed basally, usually broadest at the costa, then proceeding down along and narrowing at 2d r and 1st r-m with distal portion of subcostal area usually dark brown but sometimes almost clear, the two spots more or less interconnected by intervenational streaks from R1 to MP; the third dark brown spot sometimes indistinct, a small postpterostigmal spot, and the fourth, a small basal anal patch along inner margin; longitudinal intervenational brownish streaks along apical fourth and entire outer and inner margins of wing from pterostigma down except sometimes clear near Cu1 and Cu2; all veins brown in general except for portions in the yellowish areas of the wing and middle thirds of R2 and R3; pterostigma with long central yellowish area covering seven or eight costal cross-veins between antepterostigmal and postpterostigmal

spots; Rs usually forking into R2+3 and R4+5 below pterostigma slightly distad of or at about level of point of coalescence of Sc and R1; MA with terminal fork below pterostigma; MP1+2 usually forking proximal to or at about level of point of coalescence of Sc and R1, and forking into uneven fork, with first fork closer to stem and with first branch of first fork at an angle; Cu1 with four to six branches to margin (five most common); about 12 or 13 costal cross-veins before pterostigma; three radial cross-veins, 1st r usually basad of midpoint of free stem of Rs, 2d r to Rs, 3d r below pterostigma to Rs, R2+3 or to fork; 2d r-m usually slightly distad of 3d r (occasionally directly under) and Rs fork, the outer gradates (five) being irregular at this point; 2d m between MA and MP1+2 usually slightly distad of, occasionally directly under, 1st r-m; 3d m long, obliquely directed basad so as to make cell between 2d and 3d m as an inverted trapezoid; the inner gradates also in irregular series.

Hindwing (pl. 2, fig. 1): Average length of female 4 mm., male 3.8 mm., width of female 1.5 mm., male 1.4 mm.; membrane hyaline to yellowish; two prominent dark brown spots, the first larger (antepterostigmal spot) and the second smaller (postpterostigmal spot); faint brownish shading along about first four costal cross-veins; center of pterostigma with long yellowish portion covering seven to eight costal cross-veins; brownish veins include radial veins beyond basal forking of R, MA, distal portions of MP, cubital and anal veins (the basal portions of these veins and 1st m usually clear), the radial and anal cross-veins, outer gradates, and basal sinuous piece of MA; Rs usually forking into R2+3 and R4+5 at point basad of point of coalescence of Sc and R1; Cu1 with three to five branches reaching margin; six outer gradates, including a sectoral cross-vein.

Male genitalia (fig. 18,a–d): Eighth tergite longer mediodorsally, tapering lateroventrally, not as broad as ninth tergite; ninth tergite shorter mediodorsally and about as long ventrally and as wide as tenth tergite; tenth tergite with mediodorsal border of each half short, the ventrolateral border widened and prolonged distally; ninth sternite with appearance of a pair of median laterally curved processes extending distally from inner surface; two halves of tenth sternite almost striplike, then turning inwardly and broadened ventrally, covered with coarse, toothlike, setae-bearing papillae; parameres with a more or less diamond-shaped flap projecting usually anterodorsally from median plate, anterior margin heart shaped, posterior hooks tripartite, largest process toward exterior, smallest medial.

Female genitalia (fig. 18,e): Eighth tergite longer dorsally and shorter ventrally, anterior margin more or less convex; ninth tergite with each lateroventral half large, moderately elongate, anterior margin broadest with slight indentation near dorsal border, dorsal

border gradually sloped from proximal to distal border, ventral margin rounded, with a slight irregularity prior to articulation point.

NEOHOLOTYPE: A male (pinned) from Grant, Okla., July 1, 1937 (Standish and Kaiser); MCZ; designation by Carpenter (1940, p. 256).

ALLOTYPE: A female (pinned) with same collecting data as neoholotype; also MCZ; designation by Carpenter (loc. cit.).

Hagen (1861, p. 199) mentioned "Florida, in March (Osten Sacken)" in his original description of this species. Osten Sacken collected in Florida in March 1858, on his return from a trip to Cuba. He apparently returned from Cuba by way of New Orleans and Alabama, and, although specific Florida localities are not stated, he probably collected *areolaris* in northern Florida. (See Osten Sacken, C. R., Record of my life work in entomology, p. 7, 1903.)

Carpenter (1940, p. 256) stated that Hagen's single type of this species was probably destroyed when his collection was shipped from Europe to this country.

Both neoholotype (approximately 58 segments in both antennae) and allotype (about 57 segments in the left antenna and 56 in the right) are almost entire. The basal radiomedial streak stops at Rs, 3d r meets R2+3 just before the fork, Cu2 is clear at the margin in the forewings of both. The neoholotype shows four branches to Cu1 in the left forewing, the allotype five.

The type material of *dictyona* in the Cornell University collection was examined and the differences in the size and number of branches of Rs and Cu were found not to be of specific value when compared with *areolaris* (as was pointed out by Carpenter, 1940, p. 256). This species was described from specimens collected at Saranac Inn, N. Y., June 18 to July 1 and August 10 to 20 (Needham, 1901, p. 558). Since Needham did not designate a type for *dictyona*, the following are here designated:

LECTOTYPE: Male, June 28, 1900 (CU 50–20–32).

LECTOALLOTYPE: Female, same data as lectotype.

LECTOPARATYPES: 10 adults, same data, and 5 adults, same locality; CU 188, Sub 2. 3 specimens, same locality, Aug. 18, 1900, J. G. Needham, type 1670; MCZ.

TOPOTYPES: 42 larvae and pupae, same locality, Aug. 8, 1900; CU.

It was not possible to locate the type of *Sisyra lampra* Navás. However, the original description (Navás, 1914, pp. 60–61) appears to refer to *Climacia areolaris*, as shown by the "sectore radii unico" (single radial sector), broad subcosta, dark streak at the radial sector, and general coloration of the forewing, as well as by the six gradate veins in the hindwing (*Sisyra* has no gradates in the hindwing). Later, Navás himself (1935, pp. 33–34) placed *lampra* in synonymy with *areolaris*. The treatment of *lampra* by Carpenter

(1940, pp. 254–255) as a synonym of *Sisyra vicaria* was not based on type examination, the type being unavailable.

Distribution (specimens examined): *United States:* Alabama: 2.5 miles northwest of Moundville (Black Warrior River). Arkansas: Brasfield (Cache River). Colorado: Maple Bluff. Connecticut: Portland; Tolland; Union. Delaware Water Gap (between New Jersey and Pennsylvania). Florida: Alachua County (Lake Santa Fe); La Belle; Lake Harney; Lakeland (5 miles east of Big Creek); Punta Gorda; West Palm Beach. Georgia: Augusta; Blackshear; Clyde; 6 miles west of Concord; Dalton (7 miles south of Swamp Creek); Okefenokee Swamp (Billy's Island); 5.5 miles northeast of Perry (Tharpe's Pond); 5 miles southeast of Roberta (Beaver Creek). Illinois: Cedarville; Gilman; Hardin; Harrisburg; Kankakee (Kankakee River); Savanna. Indiana: Lake Maxinkuckee. Kansas: Manhattan. Louisiana: Forest Hill; Shreveport. Maine: Augusta; Caenis; Ellsworth; North Waterboro; Orono; St. Francis; Tim Pond; Warren; West Beach. Maryland: Plummers Island; Snow Hill. Massachusetts: Amherst; Framingham; Holliston; Lincoln; Mount Toby; Waltham. Michigan: Cheboygan County (Burt Lake; Douglas Lake); Houghton (along Keweenaw Waterway); South Haven; Twin Lakes (Houghton County); White Cloud (White River). Minnesota: Cook County (Pine Lake); 22 miles north of Duluth (Cloquet River); Houston County (Mississippi Bluff); Kawishiwi River; St. Louis County; Stillwater; west of Tower (Pike River); Wabasha. Mississippi: Natchez. Missouri: Hollister. New Hampshire: Bennington; Franconia; Squam Lake. New Jersey: Atsion; Riverton; Weymouth. New York: Clayton (Bluff Island); Hagaman; Hamburg; Hawkinsville (Black River); Hudson Falls; Ingham Mills; Juanita Island (Lake George); Kinderhook; Lima; Middleville; Milford Center; Mount Marcy (alt. 4,000 ft.); North Blenheim; Ogdensburg; Old Forge; Saranac Inn; Westchester County. North Carolina: Aberdeen. Ohio: Put-in-Bay (Lake Erie, South Bass Island). Oklahoma: Broken Bow; Grant; Sayre; Sherwood. Texas: Dallas County; Goliad. Virginia: Millsville (Milnesville?); Mount Vernon. Wisconsin: Merrill (Wisconsin River); Palmyra (river outlet of Spring Lake); Sayner (Plum Creek). *Canada:* Ontario: Biscotasing; Britannia; Burks Falls; Go Home Bay (Flat Rock Falls; Land Run Island); Honey Harbor; Maitland; Norway Point (Lake of Bays); Ottawa; Pelee Island; Waubamick. Quebec: Côteau du Lac; Gavreau Lake; Knowlton; Ste. Agathe des Monts; Vaudreuil.

The adults examined were collected from March 31 to October 10.

Northern females from Maine, Massachusetts, and New York had wings averaging 0.4 mm. longer than those of females from Florida

and Georgia. However, it was noted that a population of small specimens from Snow Hill, Md., collected in July, showed a range of from 3.7 to 4 mm. in length for the males and 4.2 to 4.4 mm. for the females. Some specimens from Florida, the state of Osten Sacken's type locality, showed a slight difference in the smaller size and the extension of the r–m streak from Sc to R only, instead of almost to

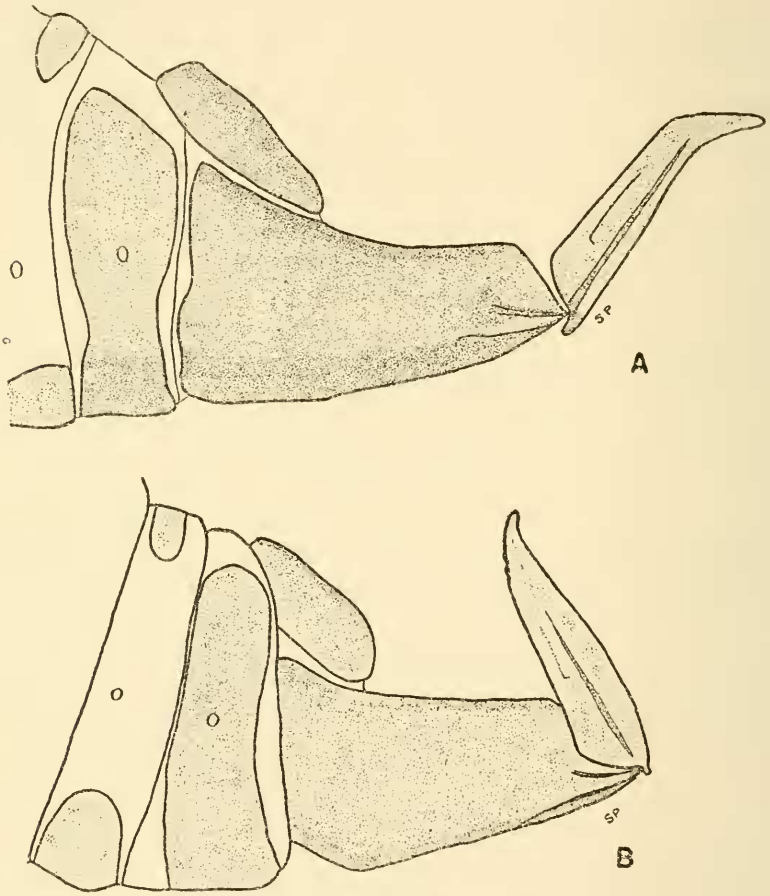

FIGURE 20.—Terminal abdominal segments of holotype, female, lateral view. A, *Climacia tenebra*, new species; B, *C. nota*, new species.

Rs. Those from La Belle tended to show reduced spotting between Sc and R1 at the point of their coalescence in the antepterostigmal streak, whereas those from West Palm Beach and Punta Gorda had the usual spotting. However, these features did not appear to warrant subspecific designation.

This is the most common species of *Climacia* in the eastern half of the United States, and the only one east of the Mississippi River. It has been taken from Maine to Florida along the east coast, and

westward to Minnesota, Kansas, Oklahoma and eastern Texas. In the western part of the United States, it is replaced by *californica* in California and Oregon, and by *chapini* in New Mexico and central Texas. The specimens referred to *areolaris* from Texas (Columbus, Schwarz; unspecified locality, Belfrage) by McClendon (1906, p. 171), and from New Mexico (Eddy County) and Texas (Sutton County, Victoria) by Carpenter (1940, p. 256) were examined and found to be *chapini*; those referred to this species from the Deschutes River, near "Richmond," Oreg., by Carpenter (1942, p. 50) were apparently *californica*. It is likely that the "pair from Bosque County, Texas, taken by Mr. Belfrage (in August)," mentioned by McLachlan in his original description of the genus *Climacia*, but not examined, are also *chapini*.

Specimens which have been recorded as this species, but which were not examined, include those from Michigan (East Lansing and Silver City), Pennsylvania, Vermont (Carpenter, 1940, p. 256), Maine (Robinson Mountain, Mount Desert Region) (Procter, 1946, p. 42); and Valle de México, Lago de Xochimilco (Navás, 1928, p. 319).

In addition to the distinctive male genitalia, a notable character of *areolaris* that separates this species from other species of *Climacia* is the 3d m, which is usually long, slightly sinuous, and sharply obliquely directed basad, making cell 2d MA the shape of an inverted trapezoid. *C. areolaris* is further distinguished from *californica*, which closely resembles it in the forewing, by the comparatively long cell 2d R1, which is more than three times as long as wide; the broader pale area (covering seven to eight costal cross-veins) in the pterostigma of the forewing and hindwing; the color of the head; the lack of a basal radiomedial streak in the hindwing and the less extensive spotting in general in the forewing and hindwing; the greater number of branches to Cu1 in forewing and hindwing; and the genitalia. It is quite distinct from *chapini* also, which has the long crescent-shaped basal radiomedial streak and a different type of genitalia. From *striata* (Panamá), which also has a similar forewing, *areolaris* can be segregated by the broader pale area of the pterostigma in the forewing and hindwing, the less pronounced dark spotting, the antennae which are not banded, and the female genitalia.

Climacia californica Chandler

FIGURE 21; PLATE 2, FIGURE 3

Climacia californica Chandler, 1953, p. 182, fig. 1 (California).

Head with vertex medium to dark brown; face with longitudinal brown streak broadest on frons below antennae, almost reaching eyes, narrower on clypeus and labrum, genae and sides of streak buff-

colored; palpi brown; antennae blackish brown (over 50 segments); legs yellow with mesothoracic and metathoracic coxae dark brown; pronotum medium brown, mesothoracic and metathoracic scutelli blackish anteriorly, pleura dark brown; abdomen reddish brown dorsally, yellowish ventrally.

Forewing (pl. 2, fig. 3): Average length female 4.8 mm., male 3.9 mm., average width female 1.7 mm., male 1.3 mm.; membrane almost

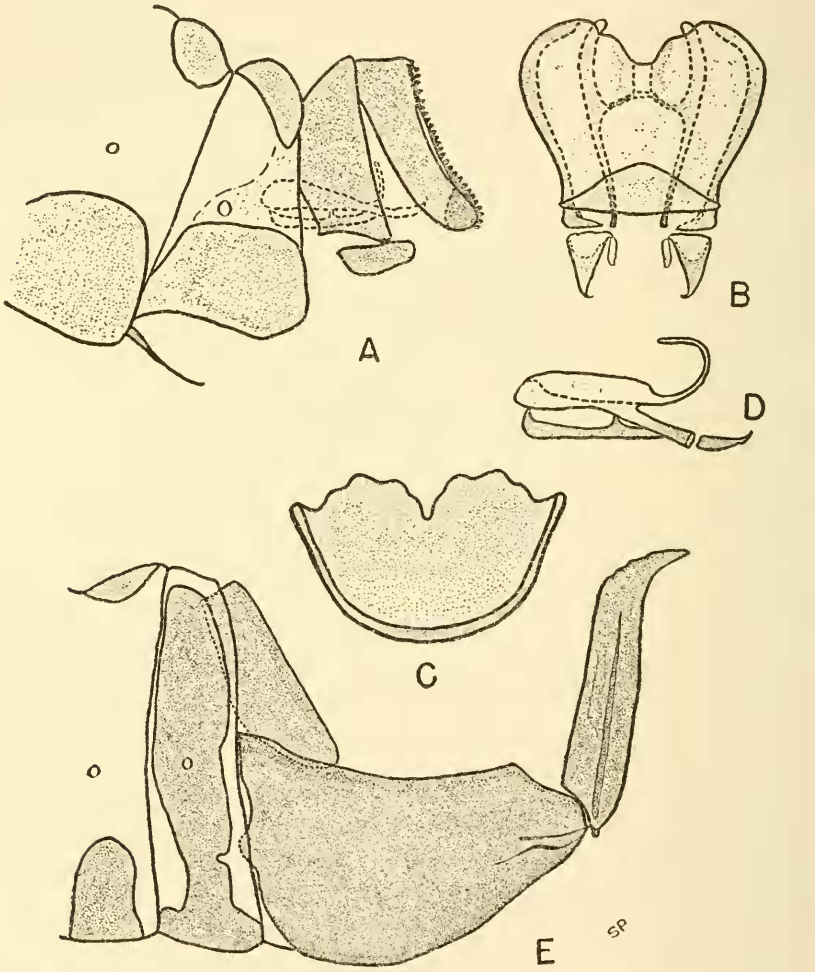

Figure 21.—*Climacia californica* Chandler. A, terminal abdominal segments of male, lateral view; B, parameres, dorsal view; C, ninth sternite of male, posteroventral view; D, parameres, lateral view; E, terminal abdominal segments of female, lateral view.

hyaline with three more prominent and one less conspicuous brownish areas, and three hyaline patches; the first prominent dark brown patch, the basal radiomedial streak, longest and beginning in subcostal space about where Sc and R almost meet basally and extending

laterally to level of about sixth costal cross-vein, then narrowing posteriorly to MP with a clear space next to Rs+MA; the second, the oblique antepterostigmal spot, directed basally, beginning and broadest at costa and narrowing to MP1+2, the two areas more or less interconnected by intervenational streaks from Rs to MP; the less prominent brownish area, beginning at dark postpterostigmal spot to basal branches of Cu1 and MP3+4, with apical portion along outer and inner margins of wing and region below radiomedial streak with light brownish streaks between longitudinal veins, darker spot over Cu1; narrow center of pterostigma between antepterostigmal and postpterostigmal spots yellowish covering three or four costal cross-veins; longitudinal and cross-veins in general pale in pale areas and dark in dark areas; Rs and MA forked below pterostigma near margin; MP1+2 with first branch forked frequently at an angle, closer to stem of MP than second fork; Cu1 with three to five branches to margin (three most often); three radial cross-veins, 1st r from R1 to Rs or Rs+MA, 2d r slightly distad of center of wing; 3d r distad of 2d r but before level of point of coalescence of Sc and R1, making cell 2d R1 between 2d r and 3d r usually not more than two or three times as long as wide; 2d r-m usually distad of 3d r between R2+3 and MA forks; 1st r-m usually directly above 2d m between MA and MP1+2, and basad of 2d m; 3d m between MA and MP1+2 basad of MP1+2 fork, close to 2d m, the cell between not more than three or four times as long as broad; five outer gradates in irregular series, usually no sectoral cross-vein; inner gradates also in irregular series.

Hindwing (pl. 2, fig. 3): Average length female 4.2 mm., male 3.4 mm., average width female 1.6 mm., male 1.2 mm.; membrane hyaline to yellowish; three dark brown spots, the first, basal from costa to Rs+MA, interconnecting with the second, the broad antepterostigmal spot, and the third a postpterostigmal spot, with light brownish shading distally along outer and inner margins from postpterostigmal spot to Cu2; pale area in pterostigma narrow, covering approximately four costal cross-veins; in general, longitudinal and cross-veins dark in dark areas and pale in pale areas, the pale and dark areas comparable to those in forewing; Rs usually forking into R2+3 and R4+5 basad of point of coalescence of Sc and R1; Cu1 with two or three branches to margin; six outer gradates.

Male genitalia (fig. 21,a–d): Eighth tergite longer dorsally, with numerous setae laterally between tergite and sternite creating effect of long and broad sternite (lateral setae between tergites and sternites abundant); ninth tergite much shorter dorsally, anterior margin convex, posterior margin almost straight; tenth tergite with each half of almost uniform length throughout, slightly longer dorsomedially and with ventral border projected slightly posteroventrally; ninth sternite with a pair of irregularly margined blunt median processes extending

distally from inner surface; two halves of tenth sternite almost strip-like for a little more than half of width, then turning internally and broadening considerably ventrally, covered with coarse toothlike papillae-bearing setae; parameres with blunt flap projecting anterodorsally from median plate, posterior hooks bipartite, with smaller process medially, inner arms curved slightly anteromedially.

Female genitalia (fig. 21,E): Eighth tergite narrowing considerably just before ventral margin, darkest brown ventrally, lighter around spiracle, anterior and posterior margins irregular; ninth tergite with each lateroventral half large, moderately elongate, anterior margin about two-thirds of length, irregular, dorsal margin slightly concave, ventral margin rounded.

Holotype: A male from Clear Lake, Lake County, Calif., May 19, 1949, elevation 1,318 feet (H. P. Chandler); CAS.

Allotype: A female with same data; CAS.

Paratypes: 27 mounted specimens (16 males, 11 females) plus several in alcohol; CAS, USNM, MCZ, California Insect Survey, and Harley P. Brown collections.

The paratypes in the USNM differ in the number of branches of Cu1 in the forewing (three or four), and in the hindwing (two or three). One paratype has 3d r and 2d m missing in the forewing, and r-m basad instead of distad of s in the hindwing.

This species has also been taken in Oregon (Deschutes River, near Redmond, July 28, 1939, Schuh and Gray; Triangle Lake, Lane County, June 16, 1952, B. Malkin). Carpenter's (1942, p. 50) record of *areolaris* from the Deschutes River, near "Richmond," Oreg., applies to *californica*. The differences noted in the paratypes were also noted in the specimens from Oregon. Those from near Redmond tended to show the vertex and thorax a lighter brown in color.

This species resembles *areolaris*, *striata*, and *tenebra* most closely. The forewing of *californica* is similar to *tenebra*, but differs from *areolaris* and *striata* in the closeness of 2d r to 3d r, which is basad of the point of coalescence of Sc and R1. The forewing of *areolaris* differs from all three species in the longer sinuous 3d m between MA and MP1+2 (usually in vicinity of angular first fork of MP1+2); the longer pale area in the pterostigma; and the usually greater number of branches to Cu1 (may reach seven). The hindwing of *areolaris* differs in the longer pale portion of the pterostigma, the absence of a definite radiomedial streak, and usually greater number of branches to Cu1. Although the female genitalia of *californica* and *tenebra* are somewhat alike, the halves of the ninth tergite of *californica* are slightly shorter in comparison with the width, and the anterior margins differ; the eighth tergite is broader in *tenebra*. The genitalia of *areolaris* and *californica* are distinct.

In *striata,* the antennae are banded with a brownish black portion between the basal and distal yellow portions, whereas in *californica* the antennae are more or less solidly brownish black, sometimes becoming only slightly lighter toward the apex. The wings of *tenebra* have the greatest amount of brown on the membrane, and are the darkest of the species of *Climacia.* The notch in the anterior margin of the male parameres is shallower in *striata* than in *californica.*

Climacia chapini, new species

FIGURE 22; PLATE 2, FIGURE 2

MALE (holotype): Head with vertex yellow, faintly reddish in center, small brownish spot behind antennal socket adjacent to eye; face yellow; palpi yellow; basal antennal segment light yellowish brown (rest missing); legs yellow, faint brownish traces on coxae; pronotum yellowish with blackish brown mottling dorsally, indication of a short longitudinal dark brown narrow streak medially not reaching anterior or posterior margin, also a shorter posterolateral longitudinal streak on each side, mesonotum and metanotum yellowish brown dorsally, pleura with brown streaks particularly anteriorly, some yellow posteroventrally; abdomen yellowish.

FOREWING (pl. 2, fig. 2): Length 3.8 mm., width 1.6 mm.; membrane yellowish with three pronounced dark brown spots, the first the basal radiomedial streak, longitudinally elongate, crescent shaped, beginning about where R and M approach each other basally, with the anterior margin of streak running slightly anterior to Rs+MA and Rs to a point between 1st r and 1st r-m, the posterior margin running along Rs+MA and MA to slightly beyond 1st m, then curving back anteriorly to meet the distal end of anterior margin of streak; the second, the antepterostigmal spot from costa to subcosta; and the third, the dark brown intervenational anal streaking basally from near 2d A to margin; most longitudinal veins brown except for costal vein to and beyond antepterostigmal spot, R1 to just before 2d r, and short basal portions of MA from radiomedial streak to slightly before 1st r-m; MP, Cu1, Cu2, 1st, 2d and 3d A pale basally; inner and outer gradates and radial cross-veins brown, bordered, subcostal cross-vein brown; costal ends of costal cross-veins yellow, subcostal ends brown except for two basad of antepterostigmal spot; pterostigmal cross-veins in center, 1st m between MA and MP1+2, 1st and 2d m-cu, cubito-anal and anal cross-veins yellow; light brownish streaks between longitudinal veins from region of outer gradates to margin and from branches of Cu to margin; Rs forking into R2+3 and R4+5 basad of point of coalescence of Sc and R1; MP1+2 with first branch at angle, closer to stem of MP than second fork; R2+3 with terminal fork slightly distad of 3d r; Cu1 with four branches to margin in left wing, three in right; three radial cross-veins, 2d r to Rs before fork,

3d r to R2+3 below pterostigma, far distad of forking of R2+3 and R4+5 from Rs; both outer and inner gradates forming a regular series; three inner and six outer gradates, including a sectoral cross-vein.

HINDWING (pl. 2, fig. 2): Length approximately 3.6 mm., width 1.5 mm.; membrane almost hyaline with one brown antepterostigmal spot; rest of pterostigma yellowish; R1, short distal piece of Rs+MA,

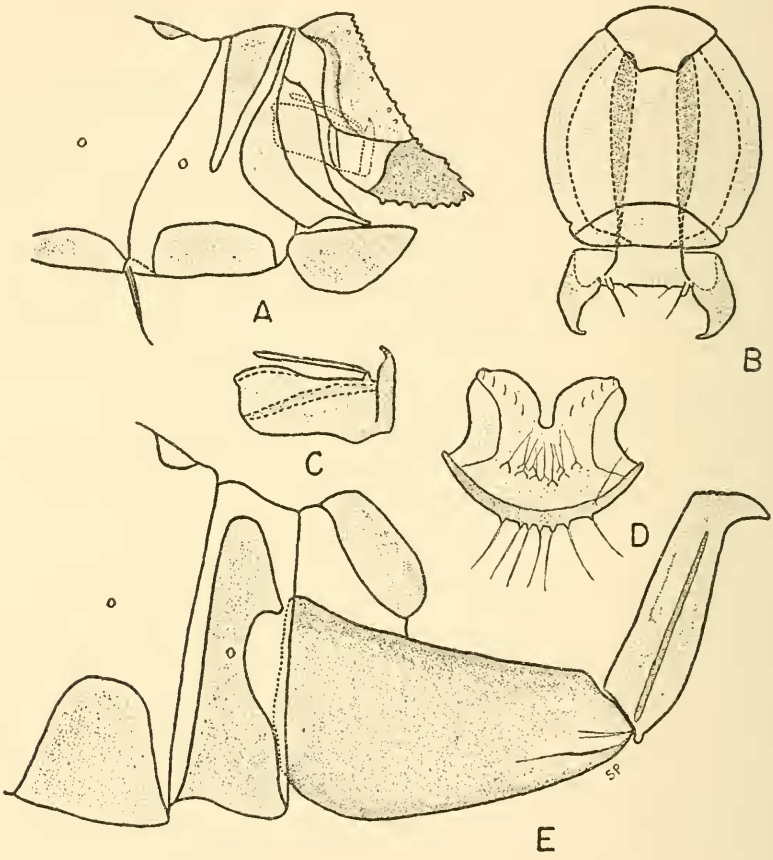

FIGURE 22.—*Climacia chapini*, new species. A, terminal abdominal segments of male, lateral view; B, parameres, dorsal view; C, same, lateral view; D, ninth sternite of male, posteroventral view; E, terminal abdominal segments of female, lateral view.

basal pieces of Rs after forking from R1 and from MA, distal ends of R2+3, R4+5, MA, branches of Cu1, radial cross-veins and outer gradates (of which s, r-m and m have pale areas in their centers) brownish, rest of veins yellow to hyaline; two branches of Cu1 to margin; six outer gradates.

MALE GENITALIA (fig. 22,A–D); Eighth tergite longer mediodorsally and narrowing lateroventrally, not as long as maximum length of ninth tergite; ninth tergite irregularly shaped, striplike dorsally, then

expanding lateroventrally with anterior and posterior margins convex in part, and then shortening again ventrally; tenth tergite with anterior border of each half more or less sinuate, with dark sinuous streak near anterior margin, posterior border straight, with coarse toothlike papillae bearing long setae, small hyaline anteroventral convex lobe with a small anterior light brown fingerlike projection; ninth sternite with a pair of median, bluntly rounded, dark, laterally curved processes which have rounded papillae in rows bearing long setae ventrally and a row of setae near dorsal margin of processes extending distally from inner surface; two halves of tenth sternite dark brown, triangle shaped ventrally, with long dentate processes bearing long setae distally; parameres with long flap projecting anterodorsally from median plate, anterior margin rounded, inner arms blackish, small elongate setigerous tubercles medial to hooks (single).

Female (allotype): Similar to male except for the following: Vertex with yellowish brown extending between the antennal bases; face with a little yellowish brown, basal two antennal segments brown dorsally and yellow ventrally, lighter than the brownish black ones following (left antenna of 58 segments); pronotum with median dorsal streak broad, narrowing before posterior margin, mesonotum also with narrow dark streak; abdomen with transverse blackish streaks dorsally; forewing length 4.3 mm., width 1.7 mm., hindwing length 3.7 mm., width 1.6 mm., 3d r at fork of R2+3 in left wing, Cu1 with four branches to margin in right wing and three in left.

Female genitalia (fig. 22,e): Eighth tergite shorter, rounded dorsally, with anterior margin almost straight and posterior border concave in part; ninth tergite with each lateroventral half large, elongate, anterior width almost one-half of and posterior width about one-fourth of length, dorsal margin sloping gradually posteroventrally, ventral margin curved; tenth tergite shorter mediodorsally.

Holotype: A male (pinned) from Columbus, Tex. (E. A. Schwarz) (Collection C. V. Riley); USNM 62262.

The date of collection is uncertain, but was probably in 1879 since Schwarz was in Columbus then. (See Proc. Ent. Soc. Washington, vol. 4, pp. 1–3, 1896.)

The holotype has the second left leg, the tarsi of the third left leg, and the antennae beyond the basal joints missing; the left forewing and hindwing are torn basally, and the left forewing is also torn near the apical margin, but the venation is distinct. The abdomen is preserved in glycerin.

Allotype: A female (in alcohol) from Corpus Christi State Park, Tex., 35 miles west of Corpus Christi, Oct. 6, 1951, at light (A. B. Gurney); USNM 62262.

The allotype is in two pieces, the anterior piece broken at the mesothorax and with the tip of the right antenna broken (of 36 seg-

ments) and possibly the left also (of 58 segments), left foreleg missing; posterior piece consisting of metathorax with third pair of legs, hindwings and abdomen.

PARATYPES: Seven. Texas: Seguin, Oct. 26, 1905, F. C. Pratt, 1 female (USNM); Victoria, June 14, 1907, J. D. Mitchell, 1 female (USNM); "Collection Belfrage," 1 female and 1 specimen with abdomen off[8] (USNM); Sutton County, July 16, 1928, R. H. Beamer, 1 female (KU). New Mexico: Eddy County, July 12, 1927, R. H. Beamer, 1 male (MCZ) and 1 specimen with abdomen off (KU).

The paratypes show variation in the amount of yellowish brown on the vertex and face, streaking of the pronotum (including the presence or absence of the median dorsal streak), position of 3d r to R2 or R2+3 (R2+3 most common) or upper branch of R2+3 fork, presence of an additional s between R2+3 fork (occasionally), number of branches from Cu1 to margin (3 to 5); and the position of 2d r to Rs or R2+3 (Rs most common). The average length of the forewing in female 4.5 mm., in male 4 mm., width in female 1.7 mm., in male 1.5 mm.

The specimen recorded as *areolaris* from Columbus, Tex. (collected by Schwarz), by McClendon (1906, p. 171) is the holotype of *chapini*. Also, the Texas material collected by Belfrage and reported as *areolaris* by McClendon (loc. cit.) and specimens from Eddy County, N. Mex., and Bosque County, Sutton County, and Victoria, Tex., noted by Carpenter (1940, p. 256) as *areolaris* prove to be *chapini*.

The adults examined were collected from June 14 to October 26.

C. chapini resembles *C. basalis* of British Guiana very closely in the wing pattern, with the main differences being seen in the longer basal radiomedial streak, the usual occurrence of a pronounced antepterostigmal spot in both the forewing and hindwing, and the lack of dotted setal pits on the longitudinal veins of *chapini*. The lateroventral halves of the ninth tergite of the female are more than half the length at anterior margin in *chapini*, but less than one-half the length in *basalis*.

This third species of *Climacia* to be found in the United States is easily distinguished from the other two species, *areolaris* and *californica*, through the wing markings and genitalia.

This species is named in honor of Dr. Edward A. Chapin, formerly curator of insects of the U. S. National Museum, whose generous and unselfish cooperation has assisted immeasurably with the completion and publication of this paper and numerous other entomological revisions.

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[8] It seems possible that these specimens originated in Bosque or McLennan Counties, Tex., since they were areas where Belfrage collected most, particularly in his later years. It has been emphasized by Geiser, however, that Belfrage collected in several other parts of Texas. The two specimens mentioned are part of the large collection of Texas insects purchased by C. V. Riley which is in the U. S. National Museum (Ent. News, vol. 44, pp. 127–132, 1933.)

Climacia striata, new species

FIGURE 19; PLATE 2, FIGURE 5

MALE (holotype): Head with vertex dark brown, shining, posterior portion with transverse yellow bar on each side extending from eye to central brown area; face yellow with median brown longitudinal streak extending from below antennal bases, narrower on frons and broadening at clypeus; palpi yellowish; basal antennal segment yellow, faintly brownish dorsally along apical margin, following six segments (approximately) yellowish (scape slightly darker), next 11–13 (approximately) brownish black, the terminal 42 yellowish (the transition between the preceding brownish black segments to the yellowish ones sharp), becoming slightly darker toward tip (left antenna of 63 segments); legs yellow, mesothoracic and metathoracic coxae brown, prothoracic coxae yellow; pronotum brown and yellowish brown mottled, with thin central blackish streak posteriorly; mesonotum and metanotum brown, slightly paler toward center, mesothoracic and metathoracic pleura brown; abdomen yellowish.

FOREWING (pl. 2, fig. 5): Length 3.9 mm., width 1.4 mm.; membrane with two interconnected prominent dark brown patches separated from a distal marginal brownish area by a large obliquely transverse hyaline area directed basally beginning at costa in center of pterostigma and extending to inner margin at Cu2, two additional basal hyaline areas; the first large dark brown patch, the basal radiomedial streak, longitudinally elongate and beginning at the costa at about the humeral vein and extending to about the fifth costal cross-vein, in the subcostal area from the subcostal cross-vein to just beyond 1st r, in the radial area from just beyond Rs+MA to slightly beyond 1st r; the second large patch, an oblique antepterostigmal spot, broadest at costa and narrowing around 2d r to near 2d m; the two patches interconnected with brownish intervenational raylike streaking between the longitudinal veins below R1, continuing in a curve to base at anal area, leaving an elliptical yellowish to hyaline spot basal to radiomedial streak; the marginal brownish area consisting of a less prominent dark brown postpterostigmal spot, and a second less prominent spot around the branches of Cu1, with intervenational brownish streaking along the outer (apical) and inner margins between the two spots; in general longitudinal and cross-veins pale in pale areas and brown in brownish areas; pterostigma with central yellowish to hyaline area covering about four cross-veins between antepterostigmal and postpterostigmal spots; Rs forking into R2+3 and R4+5 below pterostigma near margin distal to 3d r and point of coalescence of Sc and R1; MP1+2 with the first fork at an angle; Cu1 with three branches to margin in right wing and four in left wing; three radial cross-veins, 3d r under pterostigma to R2+3;

two series of gradates, three inner and five outer, in irregular series, 1st r-m slightly basal to 2d m in inner series, 3d m between MA and MP1+2 basal to 2d r-m, closest to 2d m, 3d m basal to first branch of MP1+2, and 2d r-m almost directly below 3d r and directed distally in outer series, no sectoral cross-vein.

Hindwing (pl. 2, fig. 5): Length 3.4 mm., width 1.3 mm.; membrane hyaline to yellowish or faintly tinted with light brownish, with three dark brown spots, the first spot over first five (approximately) costal cross-veins down to Rs near separation from R, the second and third brownish spots are the antepterostigmal and postpterostigmal spots; hyaline areas small, pattern in general corresponding with forewing; pterostigma with narrow yellowish center; most longitudinal veins and costal cross-vein brown in areas tinted with light brown, pale in hyaline areas; radial cross-veins and outer gradates and anal cross-vein brown; 1st m between MA and MP1+2 pale; Rs forked slightly basad of point of coalescence of Sc and R1; Cu1 with two branches to margin; six outer gradates, including a sectoral cross-vein.

Male genitalia (fig. 19); Eighth tergite small, longer mediodorsally, tapering almost to point lateroventrally, not as broad as ninth tergite; ninth tergite very short dorsally, becoming as long as tenth tergite ventrally, anterior margin convexly curved, with small anterior process before ventral margin; tenth tergite with each half of approximately same length from dorsal border to two-thirds of width, with anteroventral border tapering slightly; ninth sternite with a pair of median rounded dark processes extending distally from inner surface; two halves of tenth sternite almost striplike for over one-half of width, then turning inwardly and broadening ventrally, armed with coarse toothlike papillae, bearing long setae; parameres with flap projecting anterodorsally from median plate more or less blunt at apex, anterior margin concave in center, posterior hooks tripartite, largest process toward exterior, inner arms slender and curved anteriorly, directed anteromedially.

Holotype: A male (pinned) from La Chorrera, Panamá, May 1916 (August Busck); USNM 62260.

The holotype has the left antenna beyond the basal segment broken off and mounted below the specimen (of 63 segments), the right antenna is also broken (18 segments remaining), and the third pair of legs is missing. The right pair of wings is mounted on a balsam slide.

The female is unknown.

This is one of two species of *Climacia* from Central America, the other being *tenebra*. Although the wings of both species are very similar, they have been separated on the basis of the location of 3d r under the pterostigma, the clear spot basally with the raylike streaking around it, the broader pale area in the pterostigma, and the color

of the vertex, face and antennae in *striata*. Both the forewing and male genitalia of *striata* are also very similar to those of *californica*. However, the two species can be separated by the following characteristics: The antennae, which are banded with a brownish black portion between a basal and distal yellow portion (the latter showing a sharp transition) in *striata*, and more or less solidly brownish black in *californica;* forewing, with pronounced raylike streaking around the basal hyaline spot and the apical and inner margins in *striata*, the location of 3d r below the pterostigma and distad of the point of coalescence of Sc and R1 in *striata* (before and close to 2d r in *californica);* the male parameres with the anterior margin having a more shallow notch in *striata*, but deeper and with an additional process each side of notch in *californica*, and the apparently tripartite hooks in *striata* as compared with the bipartite ones of *californica*. C. *striata* can be distinguished from *areolaris* by the antennae (brownish black becoming slightly lighter toward apex in *areolaris*), the narrower yellow portion of pterostigma in both forewing and hindwing, the broader antepterostigmal streak, the radiomedial streak extended to the costa, 3d r-m short and directed slightly distad (long, oblique, frequently directed basad in *areolaris*), and the parameres with the narrower, frequently more curved arms and broader anterior notch in *striata*.

Climacia tenebra, new species

FIGURE 20,A; PLATE 2, FIGURE 4

FEMALE (holotype): Head with vertex yellow, a short, transverse, V-shaped spot just behind antennae not reaching lateral margins of head, another minute one on posterior margin of head; face yellow; maxillary palpi yellowish with terminal segments darker, labial palpi yellowish brown; antennae with basal two segments medium brown, following 17 brownish black (right antenna with 19 segments remaining); legs yellow, mesothoracic and metathoracic coxae brown; pronotum medium brown, mesonotum and metanotum yellowish brown, mesonotum blackish brown at anterior margin, mesothoracic and metathoracic pleura brown; abdomen yellowish.

FOREWING (pl. 2, fig. 4): Length 5 mm., width 1.9 mm.; membrane brownish mainly, blending into radiomedial streak, with some intervenational streaks below and along apical margin to Cu1, large, obliquely transverse, hyaline or yellowish area directed basally, beginning and narrowest at costa covering two or three costal cross-veins in center of pterostigma and broadening and extending to Cu1, one smaller pale area at costa before pterostigma; venation deep brown

in brownish areas and pale in pale areas in general; venation similar to *striata* except 3d r close to 2d r before level of junction of Sc and R1, with cell 2d R1 between 2d r and 3d r not more than three times as long as wide; 1st r-m slightly distad of 2d m in inner series, 3d m between MA and MP1+2 considerably basad of 2d r-m, almost directly under 3d r; Cu1 with five branches to margin in right wing and six in left; three inner gradates in regular series, five outer gradates in irregular series.

HINDWING (pl. 2, fig. 4): Length 4.4 mm., width 1.8 mm.; color pattern similar to that of forewing but membrane lighter brown; hyaline area in pterostigma very narrow, narrower than in *striata;* r between R2+3 and R4+5 distad of 2d r, the outer gradates in irregular series.

FEMALE GENITALIA (fig. 20,A): Eighth tergite shortest dorsally, lengthening considerably to below spiracle where it shortens again; ninth tergite with each lateroventral half large, elongate, with one thick posterior articulation ridge, anterior margin irregular, slightly over one-half of length, dorsal margin concave, ventral margin slightly curved; tenth tergite shorter mediodorsally.

HOLOTYPE: A female (in alcohol) from Honduras, 12 kilometers west of Olanchito, June 20, 1949 (E. C. Becker); INHS.

The holotype has the antennae broken at the apices (18 segments remaining in the left antenna). The abdomen is in a small alcohol-filled vial.

This is the second species of *Climacia* taken in Central America thus far, the first being *striata*. *C. tenebra* has the darkest wings of the species of *Climacia* examined. It is similar to *striata* in general coloration and venation, but differs in the forewing in the closeness of 2d r to 3d r; the basal position of 1st r-m to 2d m between MA and MP1+2, the more narrow pale area in the pterostigma, the termination of the oblique hyaline streak at Cu1, the more extensive brownish color of the membrane, coupled with the lack of a basal clear area and a less streaked appearance around the radiomedial streak, and the color of the vertex and antennae. In the hindwing, the basal costal blackish brown spot is less pronounced in *tenebra*. *C. tenebra* resembles *californica* in the forewing in the closeness of 2d r to 3d r, but is separated on the basis of the more narrow pale area in the pterostigmal streak, more extensive brownish color of the membrane in the forewing, and in the less pronounced radiomedial streak in the hindwing. The yellowish vertex and face and the slightly longer, less rounded ventrally, more concave anteriorly lateroventral halves of the ninth tergite of the female also distinguish *tenebra* from *californica*.

***Climacia nota*, new species**

FIGURE 20,B; PLATE 2, FIGURE 9

FEMALE (holotype): Head with vertex yellow, shining; face yellow, labrum with brownish toward anterior margin; palpi yellow; basal segment of antenna yellow, slightly brownish dorsolaterally toward second segment, second to fourth (approximately) segments yellowish brown, lighter than the following 20 (approximately) which are dark brown, the next 20 lighter brown (antennae broken, of at least 45 segments); legs yellow; pronotum yellowish dorsally, almost as long as wide, with irregular dark streaking, mesonotum and metanotum yellowish, darker laterally, pleura pale; adbomen yellowish.

FOREWING (pl. 2, fig. 9): Length 4+ mm. (apex broken), width 1.4 mm.; membrane yellowish with one prominent brownish black mark, a short, longitudinal, almost straight radiomedial streak, beginning a little basad of the point of separation of Rs and MA and extending basally between the two veins for about one-fourth of their lengths before 1st r-m, very little faint light brown streaking between the longitudinal medial veins distally from the outer gradates to margin; pterostigma yellowish; longitudinal veins yellowish or pale basally with short pieces of Sc and R1 just before coalescing brown, distal forks of Rs, MA, and MP from about 1st r-m and 1st m, Cu1 branches, and distal portions of anal veins darker in general, with macrotrichial pits bordered with brown; outer gradates brown, bordered, inner gradates in part brown, other cross-veins pale or yellowish; Rs forking basad of level of point of coalescence of Sc and R1; MA forking below above point; MP1+2 with first branch of first fork at angle, closer to main stem than second fork; Cu1 with four branches to margin; three radial cross-veins, the first just distad of end of radiomedial streak to Rs, the second at point of forking of R2+3 from R4+5, and the third below pterostigma at forking of R2+3; 2d m between MA and MP1+2 directly below 1st r-m; 3d m directly below 2d r-m from MA to MP1+2; three inner gradates and six outer gradates, including sectoral cross-vein.

HINDWING (pl. 2, fig. 9): Length approximately 3.5 mm., width 1.3 mm.; membrane unstreaked, almost hyaline; pterostigma pale yellowish; veins pale except for brownish short sections of R1 just before and beyond 1st r, both radial cross-veins, 2d and 3d A, which are darker; Rs forking into R2+3 and R4+5 at a point slightly basad of level of point of coalescence of Sc and R1; Cu1 with two branches to margin; six outer gradates.

FEMALE GENITALIA (fig. 20,B): Eighth tergite shorter dorsally; ninth tergite with each lateroventral half elongate, anterior margin more than one-half of and posterior margin about one-third of length,

dorsal margin curving slightly posteroventrally, ventral margin rounded, one posterior articulation ridge; tenth tergite shorter medially.

HOLOTYPE: A female (pinned) from the Orinoco River, Barrancas, Venezuela, Feb. 13–16 (N. A. Weber); MCZ.

Weber collected at Barrancas near the mouth of the Orinoco River at the head of the delta, inland from the lagoon west of the village in January and February 1935 (Bol. Ent. Venezolana, vol. 6, pp. 143–160, 1947).

The holotype has the right forewing, apex of left forewing, left metathoracic legs, and tips of the antennae missing (there being 45 segments remaining in left antenna and 44 segments in right). The left pair of wings is mounted in balsam on a slide, and the abdomen is in a vial containing glycerin pinned beneath the holotype.

The male is unknown.

The forewing of *nota* resembles closely that of *basalis* from the neighboring country of British Guiana. It has the shortest radiomedial streak of those species possessing one, and can be distinguished from *basalis* on this basis as well as because of the absence of anal streaking, comparative scarcity of intervenational streaking, and broader lateroventral halves of the ninth tergite of the female. The constancy of the position of 2d m directly below 1st r-m, and 3d m directly below 2d r-m will not be known until further collections of this species are made.

Climacia basalis Banks

FIGURE 23,A; PLATE 2, FIGURE 8

Climacia basalis Banks, 1913, p. 138 (British Guiana).—Navás 1933, p. 196, fig. 43; 1935, p. 37, fig. 19.

FEMALE: Head with vertex yellowish brown, shining; face yellowish, sometimes with reddish suffusion; palpi yellow; antennae with basal two segments yellowish brown, the following 30 (approximately) darker brown, the next 30 (approximately) yellowish to light brown with the transitions being gradual (of about 62 segments); legs yellow; pronotum yellowish dorsally, sometimes with a thin black median streak and other irregular streaking, mesonotum and metanotum yellowish, mesonotum sometimes with narrow black median streak, mesothoracic and metathoracic pleura with broad yellowish brown dorsoventral streaks, particularly anteriorly; abdomen yellow (with transverse blackish bands dorsally in pinned specimens).

FOREWING (pl. 2, fig. 8): Average length 4.5 mm., average width 1.8 mm.; membrane faintly tinted with yellow and with two brownish black areas; the first more prominent, the radiomedial streak, elongate, crescent-shaped, beginning slightly proximal to Rs+MA, but a little posterior to forking of Rs+MA from R1, then weakly curving and extending along Rs+MA and MA to about 1st m, from where it curves

toward costal margin again to a point slightly distad of 1st r, the second (less prominent), the brownish black area between 2d A and the margin, and between 1st and 2d A near inner margin; longitudinal intervenational light brown streaks usually from near inner gradates to margin; pterostigma yellowish, sometimes a small dark brown antepterostigmal spot; longitudinal veins yellowish except for distal portions which have setal pits bordered with brown and sometimes portion of R1 above 2d r which may be brownish; outer and inner

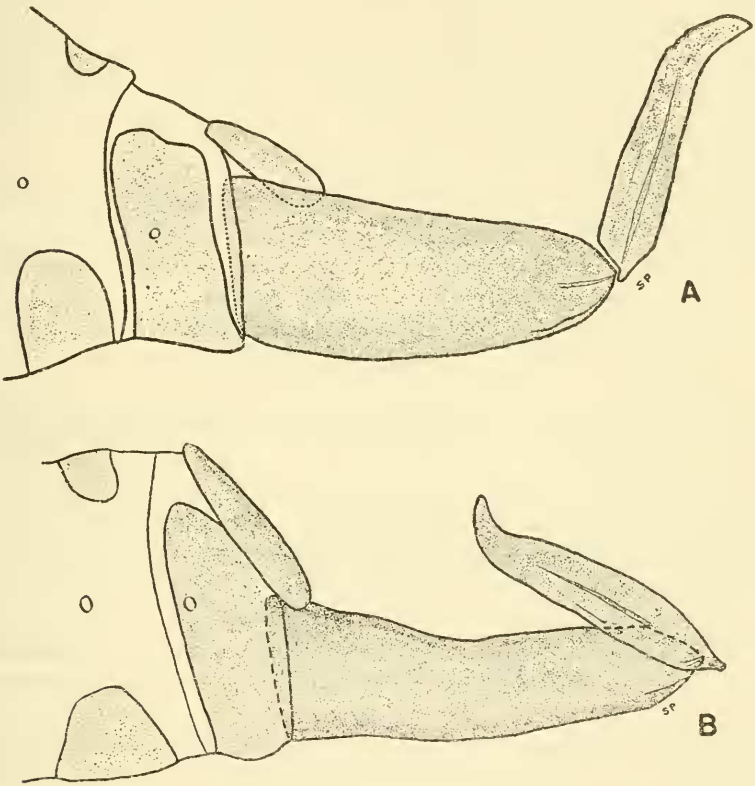

FIGURE 23.—Terminal abdominal segments of female, lateral view. A, *Climacia basalis* Banks, lectoparatype; B, *C. bimaculata* Banks, holotype.

gradates brown, bordered; basal and costal cross-veins yellow except for 1st r; Rs forked basad of level of point of coalescence of Sc and R1; MP1+2 with first fork with short stem; Cu1 with three to five branches to margin; three radial cross-veins, 3d r below pterostigma usually to R2+3; usually one sectoral cross-vein between R2+3 and R4+5 proximal to 3d r; outer and inner gradates forming a regular series, six outer gradates, including sectoral cross-vein.

HINDWING (pl. 2, fig. 8): Average length approximately 4.0 mm., width about 1.6 mm.; membrane almost hyaline; pterostigma yellow;

veins pale except for short sections of R just before and beyond, and Rs just beyond separation of R1 from Rs, of R1 just before coalescence of Sc and R1, and outer gradates (of which s, r-m, m have pale areas in centers); Rs usually forking into R2+3 and R4+5 at point basad of coalescence of Sc and R1; Cu1 with about two to three branches to margin; six outer gradates.

Female genitalia (fig. 23,A): Eighth tergite of almost even length throughout width, moderately broad; ninth tergite with each latero-ventral half considerably longitudinally elongate, with anterior width less than one-half of and posterior width approximately one-fourth of length, dorsal margin sloping posteroventrally, ventral border only slightly curved from anterior margin to just beyond midpoint, then curving more strongly posterodorsally to articulation point; tenth tergite slender, short, longer lateroventrally.

Lectotype: A female (pinned) from Bartica, British Guiana, December (Parish); MCZ 11934; by present designation.

Since no type was designated in the literature for this species, a lectotype and lectoparatypes are here designated.

The lectotype has the antennae entire (with 71 segments in left and 70 in right); the forewing shows the radiomedial streak extending below Rs+MA, Rs forked beyond 2d r, four branches to Cu1, the portion of R1 above 2d r and 1st r-m pale, no antepterostigmal spot; the hindwing shows two branches of Cu1 to margin. The mesothoracic right leg is missing.

Lectoparatypes: 10 females (pinned), with same data as lectotype; MCZ. 1 female (pinned), with same data; USNM. 1 female, with same data; CU.

The lectoparatypes show variation in the position of 2d r to Rs, R2+3, or the fork of R2+3 in the forewing; the number of branches from Cu1 (three to five in forewing and two or three in hindwing) to margin.

Topotype: 1 female (in alcohol), with slightly different data "Botica (*sic*!) Br. Guiana"; USNM. This may have been originally a cotype.

The male is unknown.

Navás (1933, p. 196; 1935, p. 38) has also recorded *basalis* from "Brazil, Corumba, Matto Grosso, Mus. de Hamburgo," but it has not been possible to procure this material in order to confirm the determination.

There is also a female (in alcohol, right wings on slide) which was found on a light socket on the steamship *Coppernane* from México on August 13, 1934. The specimen was intercepted at Philadelphia, Pa. The route of the ship is unknown, since the Philadelphia Quarantine and Customs records for 1934 have been destroyed.

H. S. Parish collected in December 1912 in Bartica, which is 40 miles up the Equessibo River, as evident from the account of his itinerary and the records of his crane-fly collections, quoted by Alexander. (Trans. Amer. Ent. Soc., vol. 40, pp. 223–255, 1914.)

This is one of two species of *Climacia*, the other being *bimaculata* Banks, with the same type locality data. The two are readily distinguishable by the occurrence of an elongate radiomedial streak in *basalis* in contrast to a tranverse one in *bimaculata*.

C. basalis closely resembles *nota* from Venezuela, from which it is separated on the basis of the longer, more crescent-shaped radiomedial streak, the anal streaking and the more elongate lateroventral halves of the ninth tergite in *basalis*. The forewing of *basalis* is also similar to that of *chapini*, from the United States, but differs in the shorter and slightly broader basal radiomedial streak (which extends from about Rs+MA to slightly beyond 1st r in *basalis*, but from the junction of R and MP in *chapini*), the small or absent antepterostigmal spot, the longer and narrower lateroventral halves of the ninth tergite of the female in *basalis*.

Climacia bimaculata Banks

FIGURE 23,B; PLATE 2, FIGURE 6

Climacia bimaculata Banks, 1913, p. 138 (Bartica, British Guiana).—Navás, 1935. p. 38.

FEMALE (holotype): Head with vertex shining, blackish brown, with color extending to a small point between antennal sockets; face yellowish brown; palpi yellowish; basal two antennal segments pale yellowish; legs pale yellowish; pronotum brownish yellow, with irregular brownish streaking and faint median dorsal streak, mesonotum and metanotum yellow dorsally, pleura yellowish; abdomen yellowish brown.

FOREWING (pl. 2, fig. 6): Length approximately 3.9 mm., width about 1.4 mm.; membrane yellowish with two distinctive large transverse dark brown spots, the first larger, the basal radiomedial streak running transversely across wing, beginning at about R1 where it is broadest, and extending posteriorly to Cu2, where it is considerably narrower, the second (the antepterostigmal) spot, of the same general shape as the radiomedial streak, but beginning at costal margin, where it is broadest, and narrowing considerably below R1 to just before Rs; pterostigma yellowish behind antepterostigmal spot; venation yellowish except for brownish outer gradates and 1st and 2d r; Rs forking into R2+3 and R4+5 basad of point of coalescence of Sc and R1; MP1+2 with first fork at a slight angle; Cu1 with three branches to margin in right wing, four in left; 1st r in radiomedial streak, 2d r just before point of coalescence of Sc and R1,

close to 3d r which is below pterostigma to R2+3; 2d m between MA and MP1+2 almost directly under 1st r-m; three radiomedial cross-veins; inner gradates in slightly irregular series, outer gradates in regular series, including a sectoral cross-vein.

HINDWING (pl. 2, fig. 6): Length approximately 3.4 mm.; width 1.3 mm.; membrane pale yellowish, with indistinct antepterostigmal spot just before pterostigma, which is yellow, outlining ends of Sc and R1 at their point of coalescence; venation pale except for 1st r, short section of Rs before coalescing with MA, which are brown, with the margin of 1st A and the free piece of MA slightly dark also; Rs forking into R2+3 and R4+5 basad of point of coalescence of Sc and R1; two branches of Cu1 to margin; two radial cross-veins with 1st r just before the R2+3 fork, 2d r before terminal fork of R2; six outer gradates.

FEMALE GENITALIA (fig. 23,B): Eighth tergite of almost uniform length throughout width; ninth tergite with each lateroventral half considerably elongate, anterior width approximately one-third and posterior width one-fourth of length, dorsal margin slightly sloping posteroventrally, ventral margin almost straight, curving posterodorsally to articulation point; tenth tergite considerably shorter dorsomedially.

HOLOTYPE: A female (in glycerin-filled vial) from Bartica, British Guiana, December; MCZ 11935.

The holotype is broken, with one part consisting of the head (with the antennae beyond the basal segments missing), the prothorax and mesothorax including left forewing (mesothoracic left leg and tibia and tarsi of right broken off), another part of the metathorax with the left hindwing (left metathoracic leg broken off) and a portion of the abdomen. The right wings are mounted on two separate slides.

This specimen was also apparently collected by H. S. Parish in 1912 when he visited Bartica at about the same time he collected *basalis*, although the collector's name is not found on the label attached to the pin (see p. 507). It was apparently originally described by Banks from a unique specimen.

In the Cornell University collection there is also a female, with the following data: "Zanderij 1, Boven Para District, Surinam, April 24, 1927, Cornell U, Lot 760, Sub. 38." This specimen has the antennae beyond the basal two antennal segments blackish brown and slightly paler apically.

This species was collected in the two adjacent countries, British Guiana and Surinam. It is readily distinguishable from *basalis* through its transverse radiomedial streak and antepterostigmal spot, and its even longer lateroventral halves of the ninth tergite in comparison with the width.

It is one of two species studied thus far possessing the transverse radiomedial streak. It can be separated from *carpenteri* from Paraguay, the other species, by the radiomedial streak, which is obliquely directed distad and of almost even length to MP, and the heavy setal spotting. The lateroventral halves of the ninth tergite in the female appear to resemble those of *basalis* and *carpenteri* most closely, but those of *bimaculata* are longer in comparison with the width. However, the hindwings are almost alike, with the holotype of *bimaculata* showing no radial cross-vein between R2+3 and R4+5 in either hindwing (possibly variable).

***Climacia townesi*, new species**

Figure 24,a; Plate 3, figure 1

Female (holotype): Head with vertex medium brown; face yellowish; palpi yellow; basal two antennal segments light brown, following segments dark brown for approximately two-thirds of length, intergrading into brownish yellow for slightly more than one-half of remaining third, the apical segments light brown; legs yellow with faint brownish shading on mesothoracic and metathoracic coxae; pronotum yellowish dorsally with reddish and blackish brown streaking, mesonotum and metanotum brownish yellow, mesothoracic and metathoracic pleura with brownish dorsoventral streaking, particularly anteriorly; abdomen yellowish.

Forewing (pl. 3, fig. 1): Length 4.2 mm., width 1.6 mm.; membrane yellowish except for dark brown streaking along inner margin basally in the space from slightly posterior to 1st A to slightly anterior of 2d A with pale streak surrounding basal portion of 2d A, entire inner margin from Cu1 branches to base dark brown, broadest at base; slight indication of faint brownish intervenational streaking between longitudinal medial veins distally from outer gradates to margin; pterostigma yellowish; longitudinal veins yellow basally, light brown distally, both inner and outer gradates dark brown with outer gradates except for 3d r and 3d m-cu bordered, 2d r of inner gradates also faintly bordered, remaining cross-veins pale except for posterior half of anal cross-vein; Rs forking into R2+3 and R4+5 proximal to level of point of coalescence of Sc and R1; MP1+2 with first fork considerably nearer to stem than second fork; Cu1 with three branches to margin in left wing and four in right; three radial cross-veins with 3d r directed obliquely toward apical margin below pterostigma to about fork of R2+3; one sectoral cross-vein between R2+3 and R4+5; 2d m directly below 1st r-m; three inner gradates and six outer gradates, outer gradates in regular series.

Hindwing (pl. 3, fig. 1): Length 3.8 mm., width 1.5 mm.; membrane almost hyaline without maculations; pterostigma yellowish; outer

gradates and 1st r slightly darker than other cross-veins which are yellowish or pale; longitudinal veins yellow, darker around radial cross-veins and from outer gradates to margin; Rs forked almost under but slightly basad of level of point of coalescence of Sc and R1; Cu1 with two branches to margin; six outer gradates, including a sectoral cross-vein.

Female genitalia (fig. 24,a): Eighth tergite slightly shorter mediodorsally; ninth tergite with each lateroventral half large, considerably elongate, anterior margin about one-half and posterior width about one-third of length, dorsal margin sloping posteroventrally in a weak curve from anterior margin, ventral margin curving posteroventrally; tenth tergite tapering slightly lateroventrally.

Holotype: A female (in alcohol) from Corry River, Brazil, July 1 (Parish); MCZ.

The holotype has the tip of the right antenna missing (61 segments remaining in right antenna, 67 in left). The abdomen is in poor condition, but the genitalia are fairly well preserved and distinct.

Paratypes: 40 females (37 pinned, 3 in alcohol), all collected by H. S. Parish. Brazil: "Corry" River, July 1 (22 in MCZ, 5 in USNM); "Santa Felipe," June 24 (1 in MCZ), June 26 (1 in USNM); Tapajos, June 30 (1 in MCZ, 1 in USNM), "June 31" (2 in MCZ). Perú: Iquitos, May 8 (1 in USNM), May 12 (1 in MCZ); Napo River, June 6 (1 in USNM), June 8 (2 in MCZ), June 16 (1 in MCZ, 1 in USNM).

The female paratypes differ in the forewing in the location of 3d r extending to the fork of R2+3, to one branch of the fork (R2), or to R2+3 (most often); 2d r to Rs or the fork of Rs (into R2+3 and R4+5) (rare); the branches of Cu1 from three to five (three most common). There is color variation in the face, which is sometimes brownish; the number of antennal segments averages 65, although from 58 to 67 were found. The average length of the forewing is 4.2 mm. and width 1.5 mm.; the average length of the hindwing is 3.7 mm., width 1.4 mm.

The male is unknown.

Adults have been collected from May 8 to July 1 in Brazil and Perú. It appears from the account of the itinerary of Parish up and down the Amazon River, as quoted by Alexander (Proc. Acad. Nat. Sci. Philadelphia, pp. 39–103, 1921) that Parish collected at the Tapajos (River) in 1919, and at Iquitos, the Napo River, "Santa Felipe," and the Corry River in 1920. It was not possible to locate the Corry River or Santa Felipe as such on maps of Brazil, but it is probable from the dates that the "Corry" River refers to the Coary (or Coari) River, and it is possible that "Santa Felipe" may either refer to a locality with a similar name (as São Felip(p)e, of which there are several in Brazil) or to a place not of sufficient importance to be in-

cluded on available maps. It might appear that more than six days (June 26–July 1) might be required to traverse the distance between those localities named São Felip(p)e found on the maps and the Coary River.

This South American species is easily distinguished from other species of *Climacia* by the absence of a basal radiomedial streak coupled with the heavy anal streaking. These features separate it from *nota*, which it closely resembles not only in the wing venation but also in the elongate lateroventral halves of the ninth tergite of the female. From *chilena*, which also has no radiomedial streak, it is recognizable by the lack of setal spotting on the longitudinal veins and the longer plates of the ninth tergite, as well as the heavy anal streaking. The location of 2d m under 1st r-m appears to be fairly constant.

This species is named in honor of Dr. Henry K. Townes of North Carolina State College, who in 1946 invited attention to the presence of *Sisyra apicalis* Banks in Florida. This suggestion led ultimately to this revision of the family from the Western Hemisphere.

Climacia carpenteri, new species

FIGURE 24,B; PLATE 2, FIGURE 7

FEMALE (holotype): Head with vertex brownish yellow, darker spot with a little reddish immediately behind antennae; face yellowish with a little reddish; palpi brownish yellow; antennae with basal two segments dark brown, rest blackish brown (31 segments in left antenna, 26 in right); legs brownish yellow, prothoracic femora with longitudinal reddish brown dorsal streak, metathoracic legs with distal ends of femora and basal ends of tibiae blackish to reddish brown; pronotum brown, lateral margins of mesonotum and metanotum darker brown, mesothoracic and metathoracic pleura with broad, anterior, longitudinal, blackish brown streaks; abdomen brownish with yellowish brown tergites and sternites.

FOREWING (pl. 2, fig. 7): Length 4.3 mm., width 1.6 mm.; membrane slightly yellowish with one larger and two smaller blackish brown spots, the first, the radiomedial streak, transversely elongate, more or less oblique, beginning at 1st r curving slightly basad along Rs and then directed distad along MA and 1st m between MA and MP1+2 for greater part of length, where there is an abrupt break, with spotting continuing along point of forking of MP1+2 and MP3+4, and Cu; the second, the small antepterostigmal spot, slightly broader at costa and covering at least partially one costal and two pterostigmal cross-veins, with faint shading at end of subcostal space between Sc and R1; the third, the smaller postpterostigmal spot, at end of pterostigma; longitudinal intervenational streaking from outer

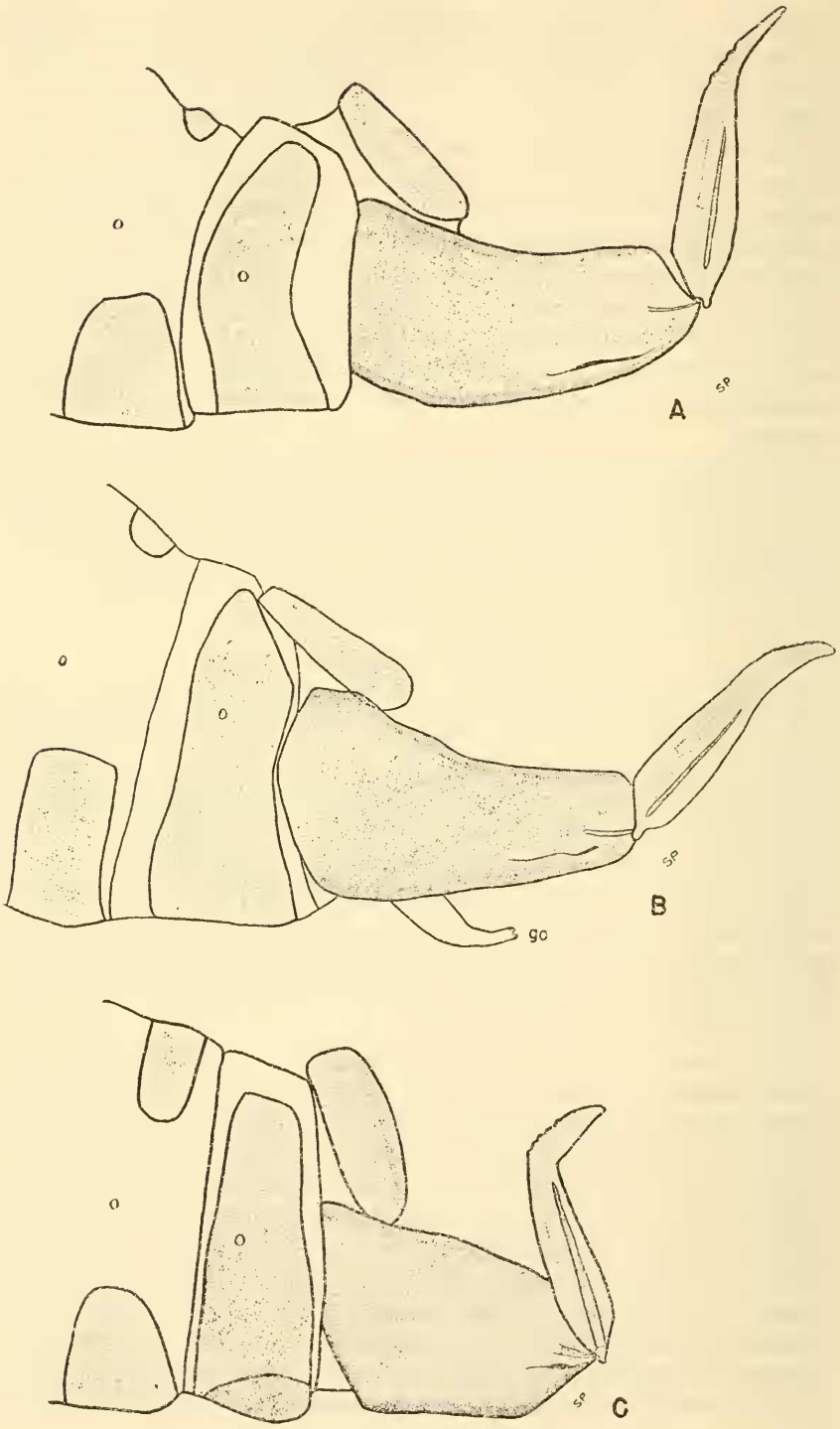

FIGURE 24.—Explanation on facing page.

gradates to margin and between branches of Cu1 to margin; longitudinal veins yellow with heavy dark brown setal spotting almost from base to margin except along C, Sc, and bases of R, M, and Cu; cross-veins heavily bordered in general except for those in basal clear area; pterostigma yellow between antepterostigmal and postpterostigmal spots; Rs forking into R2+3 and R4+5 basad of pterostigma at about point of 2d r in left wing and slightly distad in right wing; MP1+2 with two even forks; Cu1 with four branches to margin; approximately 10 costal cross-veins before pterostigma in right wing and 11 in left; three radial cross-veins, 1st r at point of forking of R from Rs; 1st r-m to free stem of Rs; 2d r-m below R4+5; 2d m almost directly under 1st r-m; 3d m basad of level of point of coalescence of Sc and R1 and forking of MP1+2; sectoral cross-vein slightly distad of 3d r, the outer gradates being slightly irregular at this point; the inner gradates also in irregular series, six outer and three inner gradates.

Hindwing (pl. 2, fig. 7): Length 3.8 mm., width 1.5 mm.; membrane almost hyaline; two small dark brown spots, the first, the faint antepterostigmal at end of subcostal space between Sc and R1, and the second, the postpterostigmal, at end of pterostigma, rest of pterostigma yellow, covering about eight cross-veins; approximately seven costal cross-veins before pterostigma; longitudinal veins yellow except for small section along R1 above 1st r, Rs from point of separation from MA to forking of R2+3 and R4+5, R2+3 basally before 2d r and distally under 2d r, and MP1+2 above and MP3+4 below 1st m which are brown; outer portions of R2+3, R4+5, radial veins and MA dotted with blackish brown setal pits from outer gradates to margin; 4th to 6th costal cross-veins and 1st and 2d r and outer gradates dark brown; Rs forking into R2+3 and R4+5 basad of level of point of coalescence of Sc and R1; Cu1 with three branches to margin; three radial cross-veins; six outer gradates in slightly irregular series, with s slightly distad of 2d r; inner gradates almost in regular series.

Female genitalia (fig. 24,B): Eighth tergite much shorter dorsally, lengthening ventrally; ninth tergite with each lateroventral half large, elongate, with one posterior articulation ridge, anterior border convex and considerably wider than posterior, dorsal border sloping markedly and curving to about midway of length, then leveling off to just before articulation point with ninth sternite; tenth tergite short mediodorsally.

Figure 24.—Terminal abdominal segments of female, lateral view. A, *Climacia townesi*, new species, paratype; B, *C. carpenteri*, new species, holotype, showing gonapophyses (go); C, *C. chilena*, new species, holotype.

HOLOTYPE: A female (pinned) from Chaco, Paraguay (Fiebrig); in Naturhistorisches Museum, Vienna, Austria.

The holotype has both antennae broken at the tip, the right hindwing torn basally in the anal area, the left folded at the costal margin, and the right mesothoracic leg broken at the tarsus. The abdomen is in glycerin.

According to Horn and Kahle (Ent. Beihefte aus Berlin-Dahlem, vol. 2, 160 pp., 1935), Karl Fiebrig collected in Paraguay in the years 1906–1909.

PARATYPE: A female (pinned), same collecting data as holotype; USNM.

The paratype has the antennae broken beyond the basal segment, the abdomen mashed terminally, but recognizable, the frons covered with debris. The right wings are on a slide.

The paratype differs from the holotype as follows: The left forewing shows 2d r to R2+3 (instead of to Rs as in holotype), 3d r to the R2+3 fork (instead of to R2+3), 2d m almost directly under but slightly basad of 2d r-m (instead of slightly distad), 5 branches of Cu1 (instead of 4) to margin; the right forewing similar to left except 2d r to R2+3 fork, three branches of Cu1 to margin; forewing length 5 mm., width 1.8 mm., hindwing length 4.3 mm., width 1.8 mm. The legs of the paratype show more extensive longitudinal dark brown streaking, and the vertex has a transverse blackish band behind the antennae, which may be superficial.

The male is unknown.

This species most closely resembles *bimaculata* through the occurrence of the transverse radiomedial streak coupled with 1st m and cu also bordered, the antepterostigmal spot, and character of genitalia. It differs in the less extensive radiomedial streak obliquely directed distad along MA, which with the bordered crossveins gives the effect of a parenthesis, and the less extensive antepterostigmal spot, both of which are distinct and broad anteriorly and narrowed posteriorly in *bimaculata*. It also differs in the strongly dotted setal spots, longitudinal intervenational streaks reminiscent of *chilena*, and in the moderately elongate latroventral halves of the ninth tergite of the female in contrast to the considerably elongate ones in *bimaculata*.

This interesting species from the center of South America is named in honor of Dr. Frank M. Carpenter, Professor of Entomology and Alexander Agassiz Professor of Zoology, Harvard University, who has made valuable contributions to the organization, knowledge, and modernization of the taxonomy of the Nearctic Neuroptera.

Climacia chilena, new species

FIGURE 24,c; PLATE 3, FIGURE 2

FEMALE (holotype): Head with vertex dark brown in center, some lighter brown laterally adjacent to eyes; face dark brown medially, paler laterally; palpi yellowish; antennae dark brown (broken, of at least 41 segments); legs yellow, coxae with a little brownish; pronotum with anterior third yellowish with a small dark brown spot on each side of central dark streak, posterior two-thirds brown with two narrow oblique yellowish spots, one on each side of central dark streak, mesonotum and metanotum brown, prothoracic pleura brown, mesothoracic and metathoracic pleura brown with yellow elongate streak medially and anteroventrally; abdomen yellowish.

FOREWING (pl. 3, fig. 2): Length 6 mm., width 2.2 mm.; membrane yellowish with no streaking other than faint brownish intervenational streaking from outer gradates, and distal portions of cubital and anal veins to margin; longitudinal veins yellowish basally with setal pits bordered with brown from about point of separation of Rs and MA from Rs+MA to margin; Sc from humeral vein to level of about 11th costal cross-vein, subcostal ends of most costal cross-veins brown; radial and cubital cross-veins, inner and outer gradates (except 1st r-m which is yellowish with brown setal pits), brown bordered; Rs forking far basad of point of coalescence of Sc and R1 near center of wing into R2+3 and R4+5; R2+3 forking under point of coalescence of Sc and R1; MA forking under pterostigma in left wing and basad of Rs fork into R2+3 and R4+5 in right wing; MP1+2 forking into almost equal forks near margin; Cu1 with four branches to margin in left wing and five in right wing; approximately 14 costal cross-veins before pterostigma; gradates in regular series, three inner and seven outer gradates in left wing, eight outer gradates in right wing, including an additional s between forking of R2+3, and an additional m between the fork of MA; three radial cross-veins, 1st r slightly distad of separation of Rs from MA, 2d r slightly distad of forking of R2+3 and R4+5 in right wing and basad in left wing; two radiomedial cross-veins. The right forewing is probably abnormal in its deep fork to MA and the crowding together of R2 and R3.

HINDWING (pl. 3, fig. 2): Length approximately 5 mm., width 2.2 mm.; membrane hyaline to yellowish; pterostigma yellowish; longitudinal veins, except for basal portion of costa, yellowish; entire length of Sc more or less (except base), short section of R1 from just before 1st r to point of coalescence of Sc and R1, short section of Rs+MA just before their separation, Rs beyond separation, very short basal portions of MA at separation from Rs, R4+5 at separation from R2+3, R2+3 to 1st r, and costal and radial cross-veins brownish;

outer gradates brown; Rs, shortly after separation from MA, forking into R2+3 and R4+5, considerably basad of point of coalescence of Sc and R1; R2+3 in right wing forking slightly distad of point of coalescence of Sc and R1 and with an additional sectoral cross-vein slightly basad of 2d r, in left wing R2+3 forking distad of 2d r and with an apparently abnormal loop ending at 2d r and with no additional s; 2d r basad of s between R2+3 and R4+5 in both hind wings (except additional abnormal cross-vein mentioned above); Cu1 with three branches to margin in right wing, and four in left; seven outer gradates in right hindwing, six in left; ten costal cross-veins before pterostigma.

Female genitalia (fig. 24,c): Eighth tergite shorter dorsally, longer ventrally; ninth tergite with each lateroventral half large, moderately elongate, with one posterior thick articulation ridge, dorsal margin sloping gradually posteroventrally, anterior margin bent at approximately midpoint at an angle, then sloping posteroventrally, ventral margin straight for a short distance before curving posterodorsally to articulation point; tenth tergite of almost equal length throughout, tapering slightly posteroventrally; ninth sternite with apex rather sharply bent and a group of about five setal pits in apical portion.

Holotype: A female (pinned) from Puerto Varas, Llanquihué, Chile, December 1926 (R. and E. Shannon); USNM 62259.

It is seen from the account of the South American itinerary of Shannon and Edwards (Edwards, *in* Alexander, Diptera of Patagonia and South Chile, pt. 1, p. xii, 1929) into the southern Andes region that collections at Puerto Varas were made on December 16.

The holotype has the left mesothoracic leg, the right antenna beyond the basal segment, and the tip of the left antenna missing (41 segments remaining in left antenna). The abdomen beyond the anterior portion of the third segment is in glycerin; the right pair of wings is mounted on a balsam slide.

The male is unknown.

This large species of *Climacia* is easily distinguished from most species by the absence of any basal radiomedial streak or other pronounced spotting in the forewing except the setal spotting. It is separated from *townesi*, which also has no radiomedial streak, through the bordered setal pits, basal position of 2d m in relation to 1st r-m, color of veins in the hindwing (darkening of veins in vicinity of 1st r), and the absence of the heavy anal streaking in *chilena*. *C. carpenteri* also has the bordered setal pits similar to those of *chilena*, but, in addition, possesses the radiomedial streak and antepterostigmal spots. The pronotal coloration of *chilena* is distinctive.

Whether the more basal forking of R2+3, the forking of MA at the center of the wing, the additional s and m cross-veins of the right

forewing, and the comparatively deep forking of Rs into R2+3 and R4+5 from the margin in the right hindwing of the holotype of *chilena* are abnormalities cannot be definitely ascertained until further material is procured.

Genus *Sisyrina* Banks

Sisyrina Banks, 1939, p. 470. Genotype: *Sisyrina nirvana* Banks, by monotypy (Banks, loc. cit.).

Brownish spongilla-flies.

Head: Antenna with basal segment longer than broad, second segment only slightly longer than remaining segments of flagellum; face short; maxillary palpi with terminal segment long, broader basally, acute apically (fig. 7,I).

Thorax: Pronotum truncate, broader than long, anterior margin considerably shorter than posterior, transverse grooves; in general similar to *Sisyra*. Tarsi with basal segment more than one-third length of tarsi.

Forewing (pl. 1, fig. 7): Costal area with about nine or ten costal cross-veins before the pterostigma; subcostal area almost as broad as broadest width of costal area, with a basal subcostal cross-vein below about fifth costal cross-vein and possibly another weak one below pterostigma; Sc atrophying at apical end with coalescence with R1 uncertain; Rs+MA separating off from R1 near base, Rs separating from MA basad of 1st r; free stem of Rs with two main forks, R4+5 separating off near longitudinal center of wing, with R2 and R3 forking slightly distad; MA forking under pterostigma; MP forking into MP1+2 and MP3+4 at base of wing and with terminal forks basad of pterostigma; Cu1 separating from Cu2 near base of wing; 3d A running free to margin; sometimes three radial cross-veins between R1 and Rs; two sectoral cross-veins, one between R2 and R3 and the second between R3 and R4+5; two radiomedial cross-veins; three medial cross-veins between MA and MP, one between MP1+2 and MP3+4; three mediocubital, one cubital, one cubito-anal and one anal cross-vein; two inner and seven outer gradates almost in regular series (except 1st s sometimes); thyridia present at point of forking of MP1+2 and MP3+4 and on outer gradates except 3d r and 3d m-cu.

Hindwing (pl. 1, fig. 7): Costal area with approximately eight costal cross-veins before pterostigma, with area immediately preceding pterostigma almost free of cross-veins; subcostal area broader than costal area with one basal subcostal cross-vein; Sc fading at apex, strong basally; Rs coalescing with MA for a longer distance than in forewing and separating from MA in center of wing and forking into two main forks, R4+5 near center of wing and a short distance beyond,

R2 and R3; MA separating off from MP at base into a free sinuate section, then coalescing with Rs; MP forking into MP1+2 and MP3+4 basad of center of wing; Cu1 separating from Cu2 near base of wing; anal veins simple; usually two radial cross-veins, sometimes both to R2; two sectoral cross-veins, one between R2 and R3 and one between R3 and R4+5; one radiomedial cross-vein; two medial cross-veins between MA and MP and one between MP1+2 and MP3+4; one mediocubital, one cubital, one cubito-anal and one anal cross-vein; seven outer gradates; thyridia on all outer gradates except 2d r and m-cu cross-veins.

Male genitalia: Tenth sternite with claspers similar to those of *Sisyra*.

Female genitalia: Similar in structure to *Sisyra*. Eighth tergite not appearing fused midventrally in *nirvana;* third sternite shorter than second; fourth to sixth sternites with posterior pale spots prominent.

In general, *Sisyrina* closely approaches *Sisyra*, the principal difference being the occurrence of a well-developed series of outer gradates in both the fore and hindwings. The termination of Sc (atrophying or free to margin) at the apex is also worthy of note.

The genus *Sisyrina* has thus far been taken in India only, and contains one species, *nirvana* Banks, from southern India (Nedungatu), which has been examined.

Genus *Sisyrella* Banks

Nopia Navás, 1910, p. 397 (not Walker, 1862, preoccupied in Lepidoptera). *Sisyrella* Banks, 1913, pp. 216, 218, new name, *Nopia* Navás.—Krüger, 1923, p. 45.—Navás, 1935, p. 70.

Genotype: *Nopia nikkoana* Navás, by monotypy (Navás, 1910, p. 397).

It was not possible to procure for study any determined specimens belonging to this genus. The genera *Sisyra*, *Climacia*, and *Neurorthus* are so distinct from each other in regard to wing venation, palpi, and genitalia that the question arises as to whether the distinctive characters in *Sisyrella* are sufficient to warrant its designation as a separate genus. On this basis, it might seem that *minuta* and *panama*, and others of the *apicalis* group, might also be placed in different genera from *Sisyra*. The following description is based upon the works of Navás (loc. cit.).

Head: Maxillary palpi with terminal segment broader basally, tapering at apex; labial palpi with terminal segment triangle-shaped, similar to *Sisyra*.

Forewing (pl. 1, fig. 8): Costal area with about ten cross-veins before pterostigma; subcostal area with one basal subcostal cross-vein;

Sc appearing separate from R1 or atrophying and indistinct at apex; Rs+MA separating off from R1 near base, Rs separating off at about the longitudinal midpoint of wing, R2 and R3 a short distance beyond; MA forking basad of level of point of junction of Sc and R1; MP forking into MP1+2 and MP3+4 with terminal forks basad of level of point of junction of Sc and R1; Cu1 separating from Cu2 near base of wing; three radial cross-veins between R1 and Rs, 1st r distad of forking of Rs from MA, 2d r distad of r-m; 3d r under pterostigma; r-m sometimes near point of separation of R4+5 from Rs; one medial cross-vein between MA and MP1+2 near forking of MP1+2 from MP3+4; three mediocubital cross-veins between MP and Cu1, the first basal, the second to Cu1 before branches, and third to branches; one cubital cross-vein; one basal cubito-anal cross-vein between Cu2 and 1st A; one anal cross-vein between 1st and 2d A; no real gradates; thyridia at point of separation of MP1+2 from MP3+4.

Hindwing (pl. 1, fig. 8): Costal area with at least six costal cross-veins basad of pterostigma, closer together basally; Sc with terminal end atrophied; Rs probably similar to *Sisyra*, separating from MA near midpoint of wing; MP forking into MP1+2 and MP3+4 as in *Sisyra;* one medial cross-vein between MA and MP1+2; one mediocubital cross-vein; no real gradates.

A female sisyrid from Wakamatsu, Japan (Aug. 22, 1949, M. Kohno), kindly sent by Mrs. Gloyd and Dr. H. H. Ross (of INHS) appears to closely approach *Sisyrella japonica* (Nakahara), which Nakahara placed in the genus *Sisyra* (1914, pp. 492–493). Sc is atrophied at the apex in the forewing. Two features which were noted upon examination of the specimen but not mentioned in descriptions of *Sisyrella* or its species are the emarginate appearance of the clypeus anteriorly, and the considerably emarginate second abdominal sternite laterally and posteriorly, with the streak almost on the posterior margin. The length of the forewing is 5.5 mm., width 2.3 mm.; length of hindwing, 4.6 mm., width 2 mm. The membrane is light brownish.

According to the descriptions and figures of Navás, the chief distinction between *Sisyrella* and *Sisyra* seems to rest upon the more apparent separation of Sc and R1 at the apex. The separation of Sc and R1 also seems to occur in *Sisyra minuta*, and appears occasionally in certain specimens of *Sisyra*. It has not been possible to procure the genotype of *nikkoana* for study, and until further investigation reveals stronger characters, *Sisyrella* should be considered a doubtful genus, scarcely distinct from *Sisyra*.

There have been two species ascribed to this genus, both from Japan: *japonica* Nakahara (1914, p. 493) from Osaka and *nikkoana* Navás (1911, p. 398) from near Tokyo.

Genus *Neurorthus* Costa

Neurorthus Costa, 1863, p. 32.—Navás, 1935, p. 19.
Sartena Hagen, 1864, p. 41.—McLachlan, 1881, p. 89.

Large, multiveined spongilla-flies.

Genotype: *Neurorthus iridipennis* Costa, by monotypy (Costa, 1863, p. 33).

Head: Antenna with basal segment sometimes almost as broad as long, slightly convex on inner margin, second segment shorter and considerably narrower than basal segment; segments of flagellum smaller; vertex convex, sometimes with large mound in center, median sulcus on vertex pronounced; face longer than in *Sisyra*, deep transverse frontoclypeal depression, anterior margin of clypeus almost straight; labrum bilobed with anterior median concavity, convex laterally; postoccipital margin of foramen slightly convex medially, concave laterally on each side; maxillary palpi with basal two segments short, third slightly longer than fourth, fifth narrow, cylindrical to midpoint, then tapering and narrowing considerably and acute at apex (fig. 7,j); labial palpi with terminal segment cylindrical, narrowing and acute at apex, sometimes extended.

Thorax: Pronotum narrower anteriorly, then broadening and rounded laterally, overlapping cervicales, posteriorly narrowing again, distinctively marked and grooved; mesothorax with prescutum large, almost same size as mesoscutellum; lateral lobes of mesoscutum slightly narrowed, oblique. Legs with first tarsal segment longest, fourth shortest.

Forewing (pl. 3, fig. 3): Costal area with numerous, sometimes forked cross-veins, sometimes as many as 24 before pterostigma; subcostal area with a basal subcostal cross-vein, and apparently a second subcostal cross-vein under pterostigma; Sc and R1 appearing separate at apex, joined by the second subcostal cross-vein; Rs+MA separating off from R1 near base and coalesced for a longer distance than in *Sisyra;* free stem of Rs usually with two main forks, R4+5 separating off near longitudinal midpoint of wing, R2 and R3 forking a short distance beyond; basal piece of MA usually distinct at base, MA deeply forked, dividing into two branches at about or slightly basal to level of point of junction of Sc and R1; MP forking into MP1+2 and MP3+4 near separation of Rs from MA; MP1+2 and MP3+4 with terminal forks under pterostigma; Cu1 separating from Cu2 near base of wing; Cu1 with marginal branches frequently forked; Cu2 sometimes, 1st and 2d A usually, and 3d A sometimes forked; usually most veins forked at margin except Cu2 and some costal cross-veins; three radial cross-veins; usually one or two sectoral cross-

veins between R2 and R3, and between R3 and R4+5; two radiomedial cross-veins between R4+5 and MA, or MA fork; three medial cross-veins between MA and MP1+2; two medial cross-veins between MP1+2 and MP3+4; three mediocubital cross-veins between MP and MP3+4 and Cu1; one cubital and one cubito-anal cross-vein, one anal cross-vein between 1st and 2d A; outer gradates of about five to seven cross-veins, inner of five to seven cross-veins; thyridia at point of meeting of MP1+2 and 1st r-m.

Hindwing (pl. 3, fig. 3): Costal area with costal cross-veins before pterostigma numerous, sometimes more than 20; subcostal area with one or two subcostal cross-veins, more narrow than in *Sisyra;* Sc not appearing fused with R1 but seemingly connected by a subcostal cross-vein to R1 at apex; Rs after branching off from R1 near base, continuing free basally for a shorter distance than in *Climacia,* then separating and proceeding anteriorly back toward R1 and forking into two main forks, R4+5 and R2 and R3 a short distance beyond; MA separating off into a free oblique piece, shorter and straighter than that of *Sisyra* or *Climacia;* MP forking into MP1+2 and MP3+4 basad of point of separation of MA from Rs; Cu1 separating from Cu2 near base of wing, with several marginal branches; usually three radial cross-veins, two or three sectoral cross-veins, two radiomedial cross-veins, two medial between MA and MP1+2 and one between MP1+2 and MP3+4, one mediocubital, one cubito-anal, one anal between 1st and 2d A; outer gradates of approximately seven to eight cross-veins, inner gradates of two or three cross-veins; thyridia not pronounced.

Male genitalia: Not studied, differing from other genera.

Female genitalia: Eighth tergite divided middorsally, fused midventrally; ninth tergite divided in two, each part moved dorsoventrally to tenth tergite, with long articulation ridge posteriorly; tenth tergite broader than long; ninth sternite divided into two broad elongate upturned parts terminating bluntly with median longitudinal streak, articulated at base to halves of ninth tergite; remaining tergites and sternites long and broad.

The position of *Neurorthus* in the Sisyridae is still not settled and it appears to be the only genus in the Sisyridae thus far showing the free basal piece of MA after it has separated from MP and before it has coalesced with R in the forewing, which is characteristic of many of the genera of the Hemerobiidae and related families (Carpenter, 1940, p. 194). Lestage (1924, p. 65; 1935, pp. 389–390) has also questioned its position in the Sisyridae. However, the character in the forewing, wherein all branches of Rs arise from a single Rs stem, is typically sisyrid. Although the life history of none of the species of *Neurorthus* has been worked out, some adults have been taken near

streams (Klapálek, 1917, p. 203; *iridipennis* in Algeria, McLachlan, 1898, p. 103).

The venation of the fossil *Rophalis* as drawn by Hagen ("*Sisyra relicta*," 1856, pl. 8, fig. 20) appears to be strikingly similar to that of the present-day *Neurorthus*. A photograph of the forewings and hindwings of a sisyrid fossil in Baltic amber (pl. 3, fig. 5) from the Kohlman collection was kindly sent by Dr. Rupert Wenzel of the Chicago Natural History Museum.

A portion of the collection of Baltic amber insects from Prussia assembled by Haren (interested in microscopy) during 1900–1920 was acquired by A. F. Kohlman (also interested in microscopy) and later purchased in 1953 by the Chicago Natural History Museum. Four of these photographs were included with the collection and were almost certainly taken by Haren himself (for stereoscopes), according to Dr. Wenzel. The main portion of the collection was acquired by the Museum of Comparative Zoology about 1938. Wenzel (1953, p. 6) concluded that since 99.5 percent of the Baltic amber (estimated between 30 and 35 million years old) comes from the Samland Peninsula north of Königsberg, Prussia, it is doubtful that any of the Kohlman specimens came from any other locality.

Unfortunately, the scientific value of the specimens was not recognized by the heirs of Kohlman after his death, and it is possible that the specimen photographed has been lost. It could not be located. The photo not only shows that the venation and other features (extruded mouthparts as seen on some specimens at MCZ; mound on head) do not differ appreciably from that of *Neurorthus*, but strongly resemble *fallax* (Rambur). Consequently, the question is raised as to whether the living genus *Neurorthus* is a synonym of the fossil genus *Rophalis*. If such proves to be the case upon actual study of the fossils, *Rophalis* (Hagen, 1856, p. 87) has priority over the present-day name *Neurorthus* (Costa, 1863, p. 32).

Neurorthus fallax was described by Rambur (1842, p. 422) in the genus *Mucropalpus*, in which other species were placed which now belong to other genera. Since Banks (1905, p. 29) designated *lutescens* Rambur (not Fabricius) (now *humulinus* Linné) as the type of *Mucropalpus*, the name is eliminated from further consideration in connection with species now placed in *Neurorthus*.

Five species have been recorded: *brunneipennis* Esben-Petersen (1929, p. 33) (Australia); *fallax* (Rambur) (Corsica; Sardinia); *fuscinervis* Nakahara (1915, p. 16) (Japan); *iridipennis* Costa (1863, p. 33) (Algeria; Bulgaria; Italy; Sardinia; Spain); *punctatus* Nakahara (1915, p. 151) (Japan).

Genus *Rophalis* Hagen

Sisyra (*Rophalis*) Hagen, 1856, p. 87.
Rhopalis Hagen, 1866, p. 459.
Rhophalis Krüger, 1923, pp. 52, 83.
Sisyra Handlirsch, 1907, p. 908.

Fossil spongilla-flies.

Genotype: *Sisyra* (*Rophalis*) *relicta* Hagen in Baltic amber, from the Lower Oligocene, designated by Hagen (1866, p. 459) by elimination (see Hagen, 1854, p. 228; 1856, p. 87, pl. 8, fig. 19; and Handlirsch, 1907, p. 908).

Numerous costal cross-veins before pterostigma; Sc not appearing coalesced with R1, but running free to margin in both wings; Rs of forewing and hindwing with two main forks far proximal to the pterostigma; inner and outer gradate series of cross-veins present in both forewing and hindwing (pl. 3, fig. 5). Maxillary and labial palpi with terminal segment long, narrow, and acute.

Although Hagen (1856, p. 87) gave no formal diagnosis of *Rophalis*, he recognized Erichson's unpublished manuscript designation of a new genus and species (*relicta*) on the labels of specimens from the collection of Berendt and Menge (about 1842, according to Hagen, 1866, p. 459). He was apparently the first to publish Erichson's name and drawings, at the same time noting a generic difference from *Sisyra*, with a description of Erichson's *relicta* (as *Sisyra* (*Rophalis*) *relicta*) and a new species *amissa* (*Sisyra* (*Rophalis*) *amissa*).

Both Hagen (1856, p. 87) and Krüger (1923, pp. 52, 57, 83) considered Erichson's figure of *Rophalis relicta* (Hagen, 1856, pl. 7, fig. 25) as erroneous. The designation as "*Sisyra relicta*" is used by Hagen (1856), for plate 8, figure 19. Hagen later (1866, p. 459) emended the spelling of "Rophalis" to "Rhopalis," one of the two spellings for the genus ("*Rhopalis*," "*Rhophalis*") which appeared on Erichson's labels, according to Krüger (1923, pp. 52, 83). Krüger gave the subgenus generic rank (as "*Rhophalis*").

The placing of a second fossil species, *Sisyra* (*Rophalis*) *amissa* Hagen (1856, p. 87, pl. 8, fig. 20) in this genus by Krüger (1923, p. 57) is questioned by Krüger himself (ibid., p. 84), who was of the opinion that the drawing is of a hindwing. Hagen, in 1856 and 1866, placed this species in *Sisyra*.

Because of the destruction of several European collections during World War II, the specimens seen by Hagen, Krüger, and Handlirsch are probably no longer available for study, and further recognition of the genus is dependent upon the acquisition of additional specimens.

The question as to whether *Rophalis* and *Neurorthus* are generically distinct is discussed under *Neurorthus* (p. 521).

A fossil fragment of the apical portion of a wing from the Oligocene (Gurnet Bay, Isle of Wight) has been identified as possibly belonging to the genus *Sisyra* (?) (*disrupta*) by Cockerell (1917, p. 381). This specimen, which is in the British Museum, was not examined for this study.

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